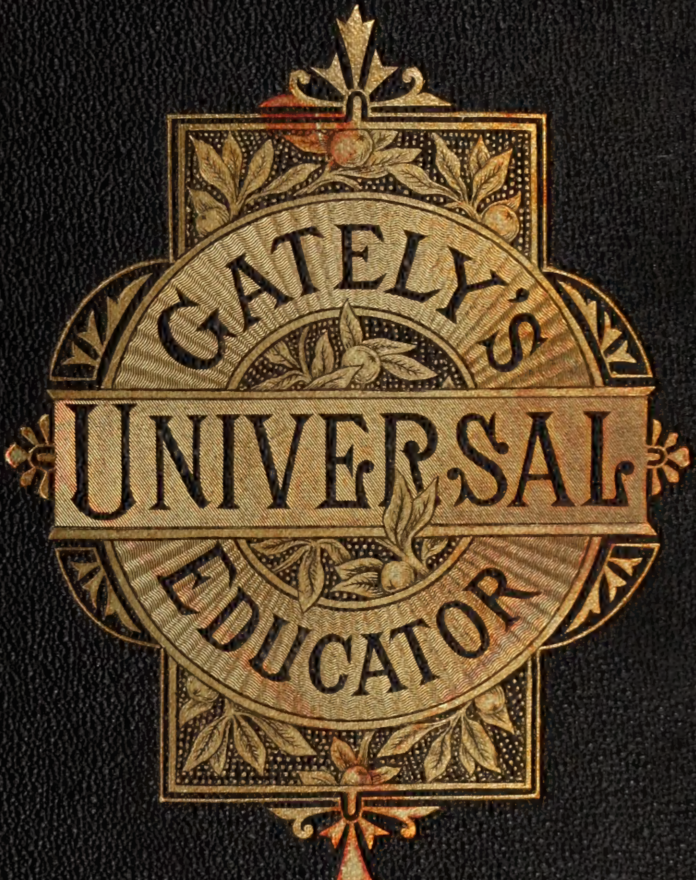

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Historical Dept.

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MONGOLIAN, OR YELLOW RACE.

CAUCASIAN, OR WHITE RACE.

AMERICAN, OR RED RACE.

NEGRO, OR BLACK RACE.

See Physical Geography, page 120.

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UNIVERSAL EDUCATOR.

AN EDUCATIONAL CYCLOPÆDIA

AND

BUSINESS GUIDE.

EDITED BY

CHARLES E. BEALE, A. M., LL. B.,

AND

M. R. GATELY.

SEVENTH EDITION REVISED. FORTIETH THOUSAND.

THREE VOLUMES IN ONE.

M. R. GATELY, 72 PEARL STREET, BOSTON.
DEWING & CO., 420 BUSH STREET, SAN FRANCISCO, CAL.

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PREFACE.

THERE is a manifest desire among the people for information on all educational subjects, as well as an increasing interest in the various businesses and trades requiring, for their successful prosecution, some knowledge of the sciences; but no work hitherto published meets this demand, and, so far as known to us, no attempt has been made in any book to unite a discussion of the general principles of the sciences and their practical application.

It has been the endeavor of the publisher to supply in this work these wants of the public, and to furnish accurate statements of principles and practical rules in such a manner as to make them easily understood. It is believed that a careful perusal of the following articles on these subjects will develop an interest in the arts and sciences among people hitherto not appreciating the benefit to be derived from the study of them.

The book also contains carefully prepared treatises upon all subjects in the subscription books now before the public under various titles, aiming to furnish general business instruction, and will be found a most complete educational work.

While the different subjects have been so treated that each subdivision is complete in itself, and the book can be used as a work of reference, yet, that the ordinary reader may thoroughly understand any subject, he should read it from its commencement; for the office of the book, as its name indicates, is that of a teacher, and each article begins with the fundamental principles of its subject, and the technical terms are explained as they occur.

For instance, in Chemistry, the natural course of investigation is pursued, and from it is developed the system of symbols or nomenclature, which is in itself an exposition of the atomic theory. Without having first mentally digested this simple, yet comprehensive, nomenclature, the subsequent pages will not be understood.

This course is also especially necessary in the Arithmetic, which from the outset uses whole numbers and decimals in connection, with full explanations, for the purpose of ridding the pupil at once of the dread of so-called decimal fractions, and for the reason that it is the natural and simple way. We believe that no arithmetic extant is so simply constructed, or has the principles so fully explained.

While space will not allow specific mention in the Preface of all the articles worthy close study, we desire to call special attention to the principal features of a few of them.

Much labor has been given to the preparation of the Physics and Mechanics, in the endeavor to simplify the wording of, and at the same time accurately state, the principles, while showing their application. Full descriptions of the most recent notable inventions occupy the latter portion of the article; and throughout it, in connection with the theoretical principles, are arranged tables and rules for the use of the practical mechanic.

In the article on Agriculture, the attempt has been made to show the use of chemistry in the application of its principles to crop raising and stock feeding, to prove that the means for large increase in the productiveness of inferior soil are within the reach of every farmer, and to illustrate how such increase can be effected.

The treatise on Medicine is a very interesting article upon the physiological, anatomical, and hygienic peculiarities and conditions of the human system, with extended and minute directions regarding the care of the sick and their general and specific treatment, including materia medica, surgery, symptoms of disease, etc., etc.

The legal matter covers a wide field, including the early history of law and lawyers, the common and statute law of England as applicable in the United States to-day, and parliamentary law; and it can be relied upon as correct, both as regards general principles and specific laws.

The article on Penmanship is unique and very valuable, from the fact that it provides spacing for the width of the letters as well as the length, and for the additional reason that script letters are used throughout the text, when other letters are mentioned, to avoid the necessity of referring to them for comparison.

Tailors' Measure is original and useful because it teaches on paper how to draught patterns and cut clothes, and is a valuable feature, as no similar article can be found in book form.

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The essay on Drawing treats of the different kinds in connection; and the mechanical part is prefaced by representations of geometrical forms, the rules of mensuration, and a description of trigonometrical principles and their application.

In the History will be found a connected account of the nations of ancient and modern times; and at its close the comparative importance of the principal countries is shown in tabular form.

A very concise and accurate statement of the principles of pronunciation of the leading European languages is contained in the article on Pronunciation of Foreign Languages; and it will be found of great assistance, to those unacquainted with these languages, in pronouncing foreign words and proper names.

In Letter Writing, social letters occupy the first part, and business letters the latter part of the article, in which business advice is also given.

The Astronomy, Physical Geography, Natural History, Geology, Mineralogy, Vegetation, Grammar, Household, and Phonography are written in a very interesting style, and are, besides, worthy of close attention on account of their intrinsic merits; while many of the other articles will, from their nature, be of popular interest.

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In the third volume will be found those subjects which aid in acquiring a knowledge of language, business methods, social customs, and the manual arts.

It is believed that this arrangement of subjects will be found most convenient; and it is hoped that the work will find that favor with the public which its wide range of information, its conciseness and clearness of statement, and its artistic appearance seem to warrant.

The publisher takes pleasure in acknowledging the courtesy of Messrs. Houghton, Mifflin & Co., in allowing the use of selections from the poetic works of Whittier, Longfellow, Holmes, and Emerson; the kindness of Mr. W. C. Bush in permitting the use of Poe's "Raven"; and that of D. Appleton & Co., in granting the request to use selections from Bryant's works.

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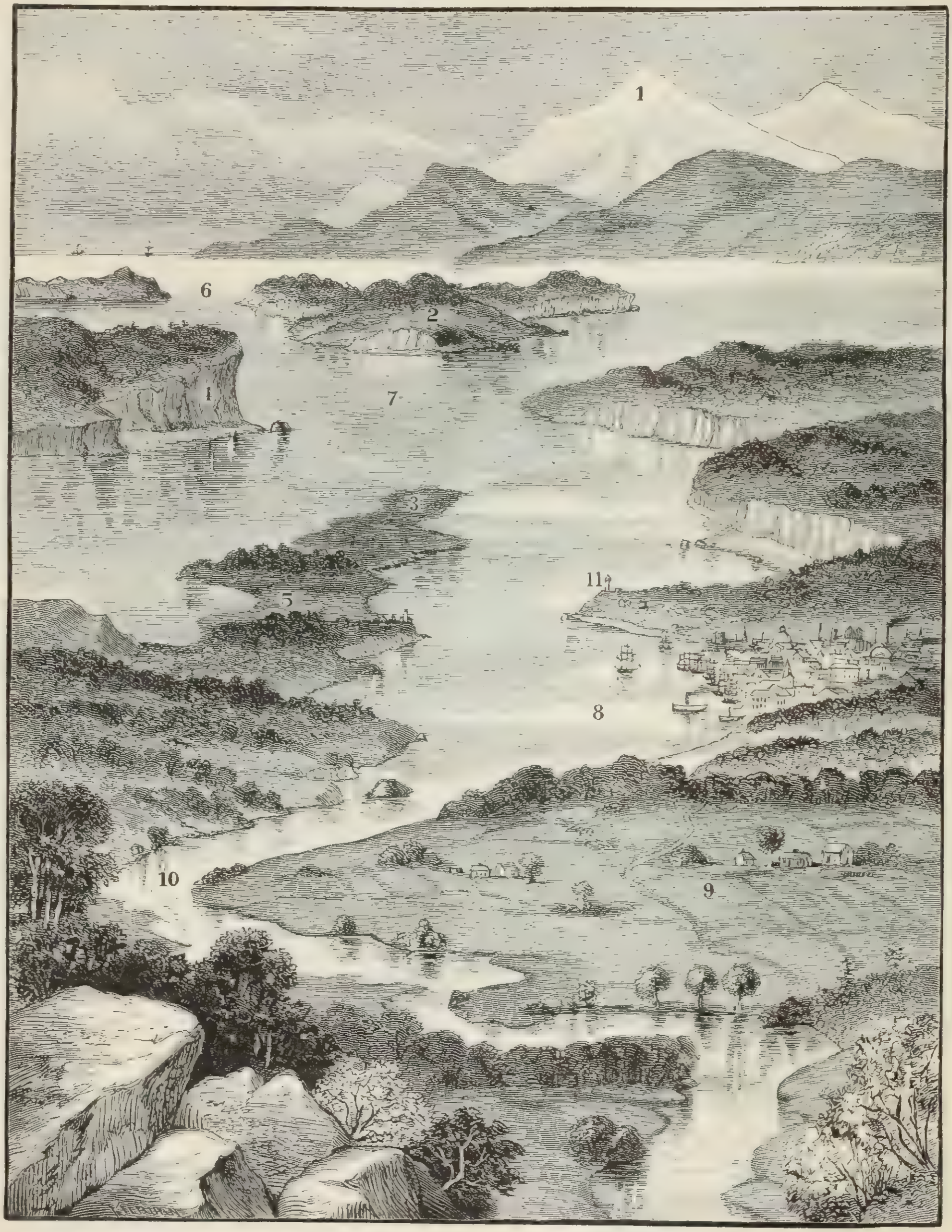

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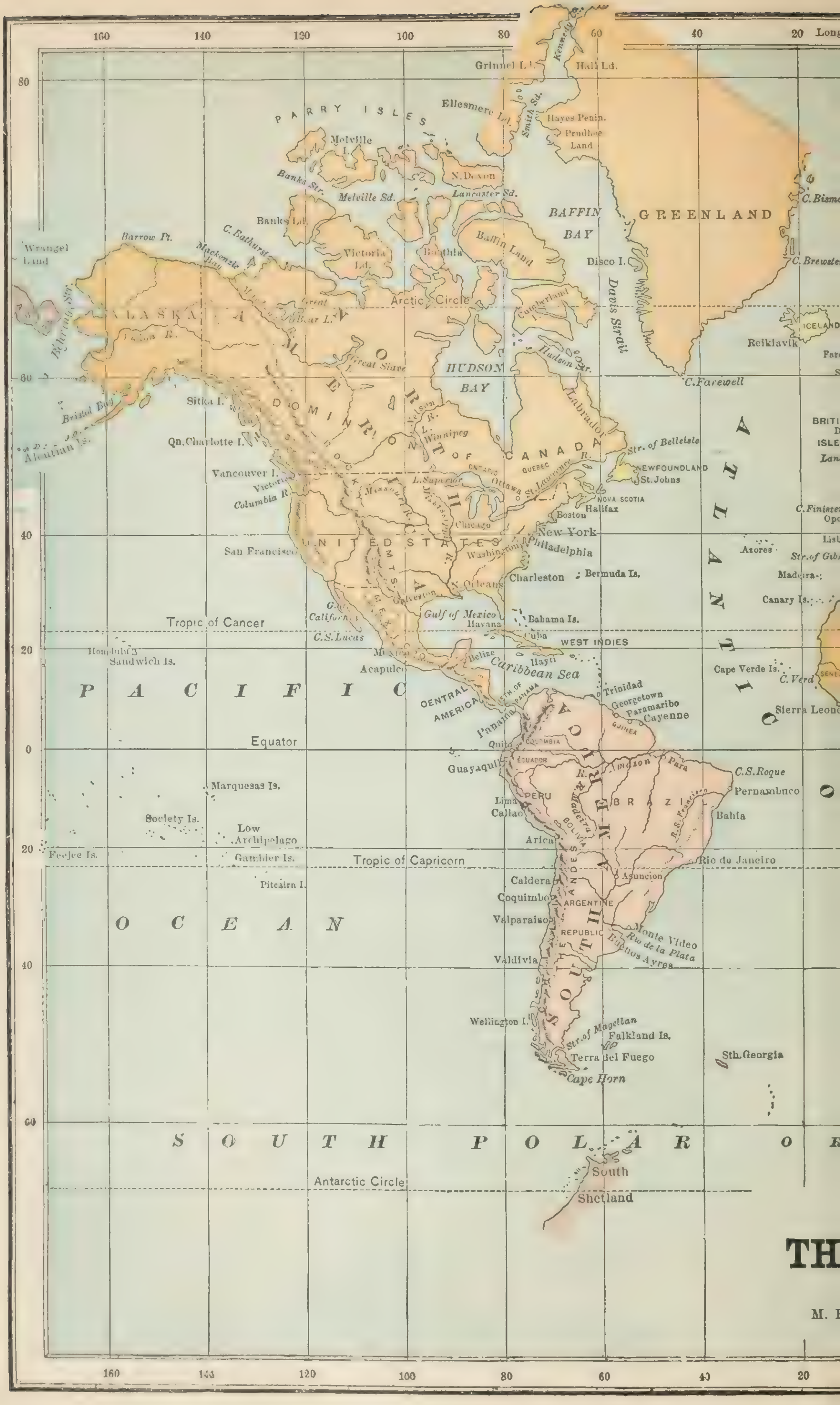
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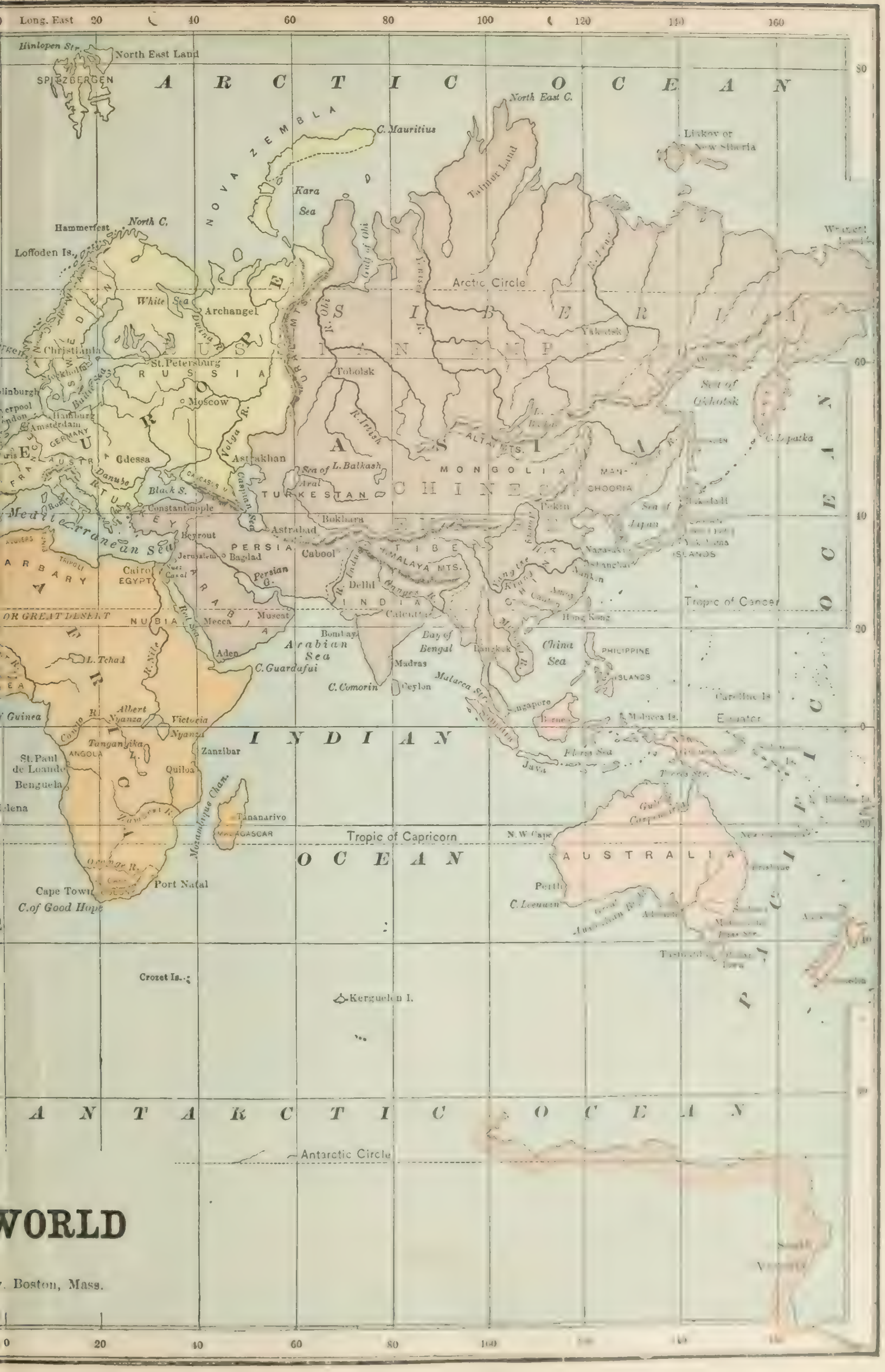

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VOLUME I.

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ASTRONOMY, MINERALOGY, METALLURGY,
PHYSICAL GEOGRAPHY, HISTORY, LEGAL MATTER.

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5. Boiler.
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7. Smoke Arch.
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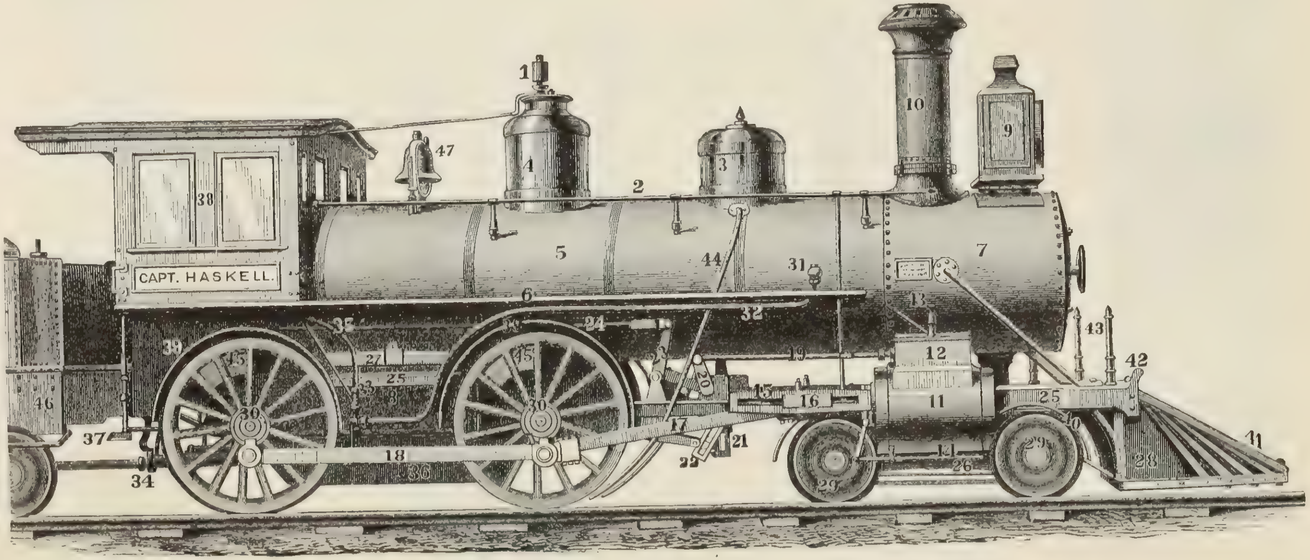

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VEGETATION.

CLASSIFICATION.

THE classification of plants was first attempted about 1583, and various methods were in use until, about 1735, Linnæus elaborated one which, although artificial, was of value. It was used for many years, but the great botanist knew that it must one day give place to a better arrangement. The natural system, which has taken the place of all former attemps at classification, is based upon the resemblances and relations of plants to each other.

All flowering plants are included in one *series*, which is divided into two *classes*; these classes are separated into *orders* or *families* of plants. An order consists of those plants which are alike in their chief characteristics. Those plants of one order, which agree most nearly, constitute a *kind* or *genus*; the differences of plants in a genus give rise to *species*. In species there may be *varieties*, produced by the skill of the gardener or by some unexplained cause. Hence plants will be grouped according to series, class, order, genus, species (variety). Upon this classification is based a key by which the names of plants may be ascertained.

DEFINITIONS.

Albumen, the starchy matter surrounding the embryo in the seed.
Angiospermous, having the ovules in a closed ovary.
  Gymnospermous, having the ovules at the base of an open pistil.
Æstivation, the arrangement of the flower in the bud.
Bast, the tough, woody cells of the inner bark.
Botany, the science which treats of vegetation. Its chief divisions are: —
    Structural botany, treating of the structure and form of organs.
    Physiological botany, treating of the mode of growth of plants and the performance of organic functions.
    Geographical, treating of the distribution of plants over the earth.
    Economic, treating of the uses of plants and vegetable products.
Carpel, a single pistil, or an element of a compound pistil; a pistil-leaf.
Cellulose, a compound of carbon, hydrogen, and oxygen, which forms the walls of vegetable cells.
Clorophyl, the green coloring-matter of plants.
Culm, the stalk of grasses.
Dehiscence, mode of opening at maturity of anthers and pods.
Diœcious, having the stamens and pistils in separate flowers on separate plants.
  Monœcious, having staminate and pistillate flowers on the same plant.
Flora of a district includes all the vegetation of that district.
Germination, the act of growth of the germ point or embryo plantlet in the seed.
Gland, an organ whose office is the secretion of a fluid.
Herb, a plant which dies down to the ground at the approach of winter, and dies wholly after ripening the seed.
  Shrub, an herb which lives year after year, and has woody stems.
  Tree, a larger shrub.

Inferior, affixed or growing below another organ.
Superior, affixed or growing above another organ.
Insertion, place and arrangement of organs.
Involucre, the whorl of bracts below a flower, or flower-cluster.
Latent buds, axillary buds which keep alive for a long time, but do not grow.
Morphology, the study of the forms of organs and their changes of form during growth.
Nectary, a gland which secretes the honey or nectar.
Node, a joint or knot of the stem.
Organ, any complete part of a plant.
Peduncle, the stem of a flower or flower cluster.
Pericarp, the ripened seed-vessel, with special reference to its walls.
Pith, the centre of an exogenous stem.
Radical, apparently springing from the root, as radical leaves.
Scape, a flower-stalk apparently springing from the root.
Spathe, a large bract enveloping the flower-cluster, as the white covering of the Calla.
Venation, mode of veining of a leaf.
Vernation, arrangement of leaves in the bud.

GROWTH OF A DICOTYLEDONOUS PLANT.

A dicotyledonous plant is one which has two *cotyledons* or seed-leaves in the seed: the stem of a dicotyledonous plant grows by additions to the outside, and the woody matter is deposited in circles or rings. The maple is a good example of a dicotyledonous or *exogenous* (outside-growing) plant.

If a maple-seed (Fig. I. A) be soaked in water and the outer coatings then carefully removed, we find, coiled and packed within, two tiny leaves and a very short stem, a plant in miniature. The tiny stem is called the *radicle* (Fig. I. B, 1), and the leaves are called *cotyledons* (Fig. I. B, 2 and 3). In some plants, a bud, called the *plumule*, consisting of more leaves, is found between the cotyledons; in the maple this does not appear in the *embryo*, as the plantlet in the seed is called. Plant some maple-seeds, and in a few days two leaves will appear above ground; they are the leaves of the embryo grown larger. The little stem has lengthened and a small root has appeared at the lower end; the leaves have not the shape of maple leaves; and it is usually the case that the cotyledons differ from the ordinary foliage of the plant. A little bud comes up between the cotyledons, and develops into a joint of stem, and a pair of leaves of the ordinary sort. The root has grown longer, and the plantlet is a maple-tree in miniature (Fig. I. C). The root spreads and deepens its hold upon the soil, and new joints of stem arise, each bearing a pair of leaves. The smaller angle formed by the union of stem and leaf is called the *axil* of the leaf, and in this axil a bud appears. This may consist of a joint of stem and leaves, and then it is the beginning of a branch; or it may be a flower-bud. The flower opens, is fertilized, and the fruit is ripened. This is the general plan of growth of all dicotyledonous plants, but there is an almost infinite variety of slight differences. To this class belong our forest and shade trees, and most of our Northern flowers.

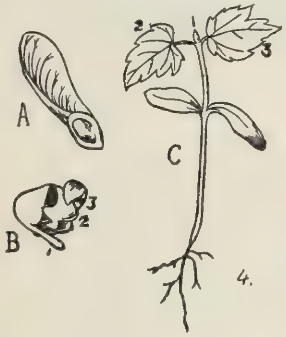


Fig. I.

GROWTH OF A MONOCOTYLEDONOUS PLANT.

A monocotyledonous plant has but one cotyledon; and, when its stem lasts more than one season, the woody matter is scattered through its substance, the old wood being nearest the outside. So a monocotyledonous plant is also called an *endogenous* (inside-growing) plant.

If a grain of corn be soaked and then carefully examined, we shall see one cotyledon (Fig. II. B), surrounded by starchy matter (Fig. II. A); plant some grains, and soon a scale-like leaf will appear. This is not the cotyledon, as may be proved by pulling up a specimen. Another leaf grows from within the first, and so on; when the flower-stalk comes, it is from within this sheath of leaves. The flower and the fruit mature, as in the dicotyledonous plants. To this class belong palms and other tropical trees, the lily family, cat-tails, and orchids.

THE ROOT.

The chief purpose of the root is to absorb nourishment from the ground to which it fixes the plant; sometimes it stores that nourishment for future use.

The form of the root varies; the first which appears is called the *tap-root.* If that branches immediately, or others grow equally with it, the plant is said to have *fibrous* roots (Fig. II. C).

Sometimes the tap-root is only the leader of several large roots, as in most trees. In other cases, no other than the tap-root starts, and that becomes thickened with the nourishment which it is storing for the use of the plant the next season.

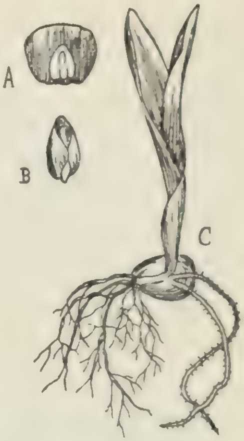


Fig II

Fleshy roots, a they are called, are of various shapes, as the turnip (Fig. III. A), carrot, and radish; sometimes there are several or many of these thickened roots, as in the sweet potato (Fig. III. B).

The FOOD OF PLANTS consists of carbon, which comes from the carbonic acid of the air; water, which is directly absorbed by both leaves and roots; and the elements, nitrogen, potassium, phosphorus, chlorine, magnesium, calcium, and iron: these, as compounds, are dissolved in water and enter by the roots. Other elements are often found in the tissues of plants, but experiments have proved them to be non-essential to growth.

Nourishment is absorbed by the whole surface of the root when young; but if the plant grows old and woody, only the tender shoots do the work. The absorbing surface is increased by little root-hairs (Fig. IV.), such as may be seen in great numbers on a young maple-root. The very tip of the root, while the plant is growing, does not absorb food, but devotes itself to feeling its way through the soil; this is the most sensitive part of the plant.

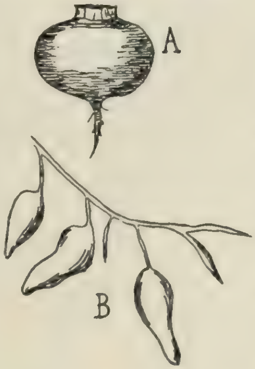


Fig. III

The *root loves darkness*, and grows always downward; other joints of the stem may bear roots, as may be seen by pulling up almost any running plant, which will be found to have struck root wherever it touched the ground.

Aerial roots are those borne so high upon the stem that it is impossible they should reach the ground. The ivy bears aerial roots to aid it in climbing.

PARASITES.

Some plants do not take nourishment directly from the soil, but live upon other plants. Such are called *parasites*, and are of two sorts, — those having no green parts, as the fungi; and those having green parts, as the mistletoe.

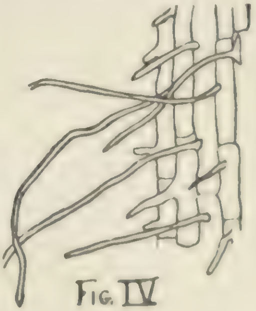


Fig. IV

The mistletoe is a parasite on the branches, and the comandra on the roots, of plants. The dodder, a common summer parasite, looks like a skein of yellow yarn twisted about the source of its nourishment.

Parasites should not be confounded with *air-plants*, or epiphytes, which earn their own living, although firmly attached to some other organism. They obtain all their food from the air, and so require no connection with the soil. The so-called moss, which hangs from the trees in the South, is a good example of an air-plant.

THE STEM is formed by the lengthening of the bud of the embryo: it bears the leaves and branches which make up the plant. The stem above ground may be *erect*, as that of the maple; *prostrate*, on the ground, as the portulacca; or *climbing*, as the morning-glory.

The various forms of underground stems resemble roots. The *rootstock* (Fig. V.) is an underground stem, producing, at each joint, roots and a bud, from which grows the plant. The Solomon's seal grows from a rootstock. Growths from such buds are called *suckers;* and plants provided with this means of propagation multiply rapidly. When only portions of the rootstock thicken, *tubers* are produced, as white potatoes.

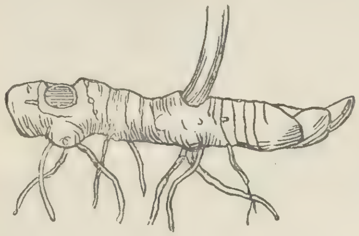


FIG. V

A *corm* is a short subterranean stem, very much thickened by its store of nourishment, the leaves being reduced to mere scales. The crocus grows from a corm.

A *bulb* is also a form of subterranean stem; but in this case the food is stored in the leaves, and the short stem is insignificant. The onion and hyacinth are bulbs.

Each joint of the stem produces one or more leaves, and in the axil of each leaf a BUD is formed. A bud is *terminal* at the end of a stem or branch (Fig. I. C, 1): *axillary*, growing in the axil of a leaf at the side of the stem; or *adventitious*, when it appears at any other point as the result of an injury.

When more than one bud appears at a point, the additional ones are called *supernumerary* buds (Fig. VI. *b b*).

Buds which are formed in the fall to live through the winter, like the buds of the horse-chestnut, are provided with a sticky, resinous covering as a protection from the weather. When BRANCHES above ground strike root and form new plants, they are called *stolons*, *offsets*, and *runners*.

Tendrils are slender branches, which, being used only for aid in climbing, seldom need or produce buds. One kind of tendril fastens itself by hooking the end about a support, and then, by coiling itself, it can lift the plant; another sort attaches itself by a flat disk or sucker. Branches also appear as *spines* or thorns, as in neglected pear-trees.

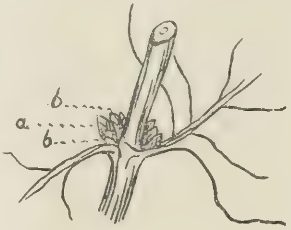


FIG VI

LEAVES.

The green leaves absorb carbonic acid, which under the action of sunlight is decomposed; the oxygen is given back to the air, and the carbon is retained to aid in the growth of the plants.

Leaves are *deciduous*, falling at the approach of winter; or *persistent*, remaining for a year or more upon the tree. The arrangement of leaves on the stem may be *alternate* (Fig. XI.) when the leaves are placed in a regular rank spirally on the stem; or *opposite*, when placed directly opposite each other in the same plane (Fig. I. C).

Whorled is simply a variation of the opposite mode, in which two or more leaves appear in the place of one.

A *cluster* of leaves, as in the pine, is the result of a shortened stem which has brought all the leaves of a branch together.

A leaf is *stalked* when attached by a little stem or petiole; *sessile* when attached directly, or *sheathed*, as in the grasses; *simple* when all of one piece, as the maple and ivy; *compound* when made up of several lesser parts or leaflets, as the pea, rose, and horse-chestnut.

A leaf is *digitately compound* when the parts diverge from a point, and are spread out like the fingers of the hand (Fig. VII.); *pinnately compound* when the parts separate from a central stem or mid-rib, like a feather (Fig. VIII.).

The margin may be *entire* or smooth, as the ivy; *serrated* or saw-like, as the rose; *toothed*, as the holly; *lobed*, as hepatica; *cleft*, as maple; or *divided*, as rose-geranium. A leaf is *parallel-veined* (Fig. II.) when the fibres run parallel with each other from base to tip, as in the lily; or *netted-veined* when the fibres, branching from a central one called the *mid-rib*, cross and interlace each other, as in the violet leaf or rose (Fig. VIII.).

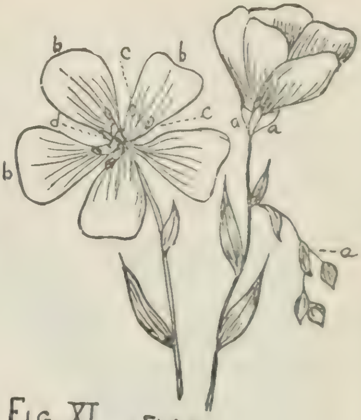


FIG. XI FLAX

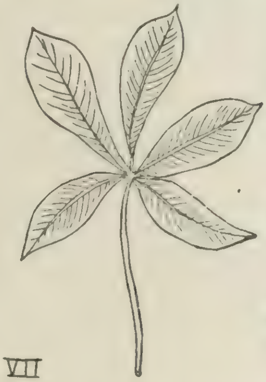


FIG. VII

The *shape* of a leaf should be noted, as, for instance, whether it is round, heart-shaped, oval, or long and narrow.

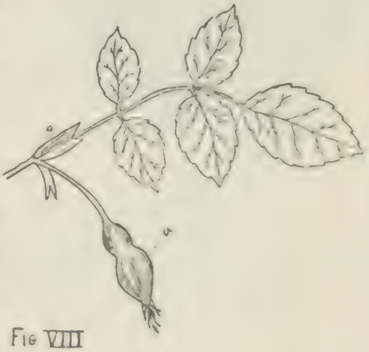
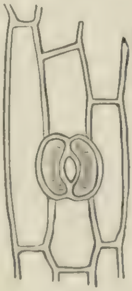


FIG VIII

PARTS OF THE LEAF.

Blade, the extended part, to which we commonly give the name of leaf (Fig. I. C, 2); *petiole* or stalk, (Fig. I. C, 3); *stipules*, a pair of appendages sometimes found at the base of the stalk (Fig. VIII. A). The upper surface of a leaf is usually darker than the under, because the cells containing the green coloring matter, or chlorophyl, are more closely packed on the upper side. The looser structure of the under surface allows of a vastly larger number of breathing holes or *stomata* (Fig. IX.). These are the means by which plants absorb and breathe out. The stomata are provided with valves, which regulate the rapidity of the evaporation.



IX

Although foliage is the most important office of leaves, it is not the only one: in plants like the houseleek and century-plant, the leaf not only furnishes nourishment, but also stores it up.

The cotyledons of the acorn do not come above ground, because they are so swollen by the starchy matter which they have stored for the young plant as to be misshapen, and wholly incapable of performing the office of foliage: in some cases, however, the leaf is able to assume its ordinary duties after having given out this extra accumulation of food. Some seeds contain so much nutritious matter that we use them for food, as peas, beans, and almonds.

Bracts are leaves which grow near, or are connected with, the flower-cluster (Fig. XI. a).

sometimes they have a color, as the brilliant red bracts of the poinsettia. Leaves also appear as *scales* on bulbs and buds. In the scaly buds of the horse-chestnut, the outer leaves are changed so as to form a protective covering for the others.

In the barberry, some of the leaves are changed into spines. Leaves may be transformed to tendrils, though tendrils are more often branches.

One of the most interesting of the curious forms which leaves may assume is the pitcher, to be seen in the common pitcher-plant of our Northern bogs. In another variety, the pitcher has a lid which opens by a hinge when the leaf is full grown (Fig. 10). It is stated that these pitchers have been found on the mountains of Borneo with a bowl large enough to drown a small animal or a good sized bird. There are upwards of thirty varieties of this carnivorous plant. It is successfully cultivated, and requires a copious supply of liquid, a very damp atmosphere, much heat, and not too much light.

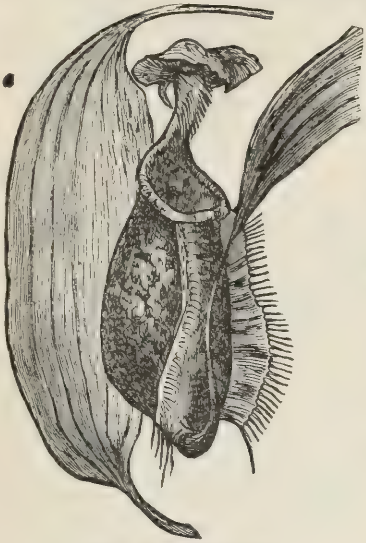


FIG. 10. — Pitcher-Plant.

To protect the interior of plants, leaves have a waxy coating, or thickened layer of cells, upon the outside, and are sometimes defended by a sting, as the nettle is, and are made attractive to insects by the secretion of nectar. *Vernation*, or the arrangement of leaves in the bud, is observed with interest. Thus, currant leaves are crimped, ferns are rolled from the tips, and grasses are simply wrapped one about the other.

Root, stem, and leaves are the essential parts of a plant, all other forms being only modifications of these: the flower and all its parts are leaves modified and changed for certain specific purposes.

Some *parasites* have no leaves; for example, the dodder. The cacti, which grow in hot countries where there is no rain for months at a time, are condensed so as to present the least possible surface for evaporation, and hence have no leaves.

Asparagus and smilax are also leafless plants; what we call their leaves are really branches.

INFLORESCENCE.

Inflorescence is the mode of arrangement of flowers upon the stem. Inflorescence is *determinate* when it grows from a terminal bud (a single flower is produced, or a *cyme*, a flat-topped cluster, the inner flower of which blossoms first); *indeterminate* when the flowers grow singly or in clusters from axillary buds. The various forms of flower cluster receive special names: the most common are the *Raceme*, as lily of the valley; *Spike*, plantain; *Head*, clover; *Spadix*, calla; *Catkin*, birch.

THE FLOWER may be regarded as a condensed branch, the leaves of which, much crowded together, are changed in various ways: the object of the whole transformation is to enable the plant to produce seed.

PARTS OF THE FLOWER.

ESSENTIAL PARTS. — *Pistil*, *Stamens*. If a flower has both of these, it is called a perfect flower, as it has the parts necessary for reproduction. If it lacks one or both, it is *imperfect*. Double flowers have their essential organs changed to petals, and so do not produce seed; they are then said to be *neutral*.

FLORAL ENVELOPES. — *Calyx*, *Corolla*. When the floral envelopes are alike in color, they are collectively called the *perianth*. If a flower has both floral envelopes and essential organs, it is *complete*.

The flower is *regular* if all parts of one sort are alike, as the flax; *irregular*, if the parts of a sort differ, as the petals of the violet; *symmetrical*, if there is an equal number of parts of each sort.

The parts of the flower are attached to a central axis or receptacle, which sometimes grows soft and fleshy, as in the strawberry. In many cases, two or more sets of parts grow together: different names are given to express the mode of consolidation, and the arrangement of parts on the receptacle.

Flowers are formed on a regular plan: thus, the flax, a perfect, complete, regular, symmetrical flower (Fig. XI.) has 5 sepals (*a*), 5 petals (*b*), 5 stamens (*c*), 5 pistils (*d*); the violet has 5 sepals, 5 petals, 5 stamens, and 1 pistil. The most common plan is that in which the number 5 appears in all the parts: the number of stamens may be any multiple of 5, and the number of pistils may vary. Next to 5, 3 is most frequently the plan of the flower, as in the lily.

The use of the CALYX (Fig. VIII. A) is to protect the other parts of the flower, particularly in the bud. If the parts of the calyx called the *sepals* are united, the calyx is said to be monosepalous; if separated, polysepalous. The sepals are usually green and leaflike; but they are often of the same color and texture as the petals, as in the snowdrop. When a flower has but one set of envelopes, it is always considered to be the calyx. The upper part of the calyx is occasionally divided into fine hairs, forming the down or *pappus* of thistles, which aids in the dispersion of the fruit when ripe.

The COROLLA is the whorl of leaves next above and within the calyx: its parts, called *petals*, are usually white, or some bright color. If these parts are separated from each other, the corolla is said to be polypetalous; if united in one, monopetalous. Two peculiar shapes of the corolla have been given special names, as the *papilionaceous* or butterfly corolla of the sweet-pea, and the *strap-shaped* corolla of the sunflower. Sometimes one petal is drawn out to form a spur, as in the larkspur.

The STAMENS are the male organs which produce the pollen for the fertilization of the pistil. The parts of a stamen are:—

The *anther*, which bears the pollen, is usually two-celled, and, when ripe, opens to discharge its contents, either lengthwise, by a hole in the top, or by raising one side of its wall.

The *filament*, the thread-like stem which supports the anther, is not an essential part, and so may be absent, in which case the anther is said to be sessile. Stamens, if united, receive names to express the mode of union and the number in each set. If all the stamens are united by the filaments into one set, they are said to be monadelphous.

POLLEN consists of fine yellow grains made up of two coatings surrounding a thick fluid. Pollen grains are not considered modified leaves, but cells, having a special office to perform,—that of germination. Plants produce pollen abundantly; and so-called sulphur-showers are caused by the fall of vast quantities of pine pollen blown by the wind.

The *pistil*, the female organ, is usually the most carefully protected part of the flower. It consists of the OVARY, containing the ovules, which, by the fertilizing action of the pollen, are to be developed into seeds. Pines and similar trees bear *cones*, each leaf of which is an *open pistil* bearing two or more ovules at its base.

Stigma, the flat, commonly sticky surface on which the pollen falls.

Style, or stalk for the stigma, a non-essential part: in its absence the stigma is sessile.

The OVULE has two coatings, in which a small hole called the *micropyle* appears, through which the pollen tube is to enter. Within is a nucleus, which, by the agency of the pollen, will grow into the embryo.

In making a careful cross-section of an ovary, we notice that the ovules or rudimentary seeds are arranged in regular order upon soft projections called *placentæ*: this order varies in different families of plants.

A pollen grain is received on the stigma: its inner coating expands into a tube long enough to reach down to the ovules. The time required for fertilization varies from a day to six months. The *flower droops* as soon as its pollen is discharged. Acting on the knowledge of this fact, the florist cuts off the anthers of Easter lilies, that the flowers may keep the longer.

A *pistil* is seldom fertilized by the pollen of its own stamens, but by that of another flower of the same species. Insects and the wind are effective agents in this work: bees in search of honey brush the pollen off one flower on to their bodies, and then, going into the next, it falls from them to the stigma, and thus germinates.

All insects do not accomplish such a benevolent purpose when visiting flowers, and such are forcibly kept out by a growth of prickly hairs, or by water in the calyx; the latter is a method of protection against ants.

In the seed, the *microphil* is seen only as a tiny dot; and a scar, called the *hilum*, marks the place where the ovule joined the placenta. The two seed-coats enclose the embryo, and the food which is to nourish it when it begins to grow. This food may be stored in the seed-leaves themselves, as in the acorn; or around them, as in the morning-glory.

SEEDS.

Plants often produce seeds in immense numbers; for instance, a peony may ripen about 30,000. Some seeds are especially adapted for wide distribution, as the dandelion (Fig. XII.): oily seeds can travel long distances on the water; seeds like those of the burdock are carried in the wool of animals. The seeds of the clematis have down, by which they float on the breeze; and a sharp point, by which they plant themselves as they fall. If every seed produced should grow into a plant, the earth would be too full of vegetation; so there are arrangements for preventing the germination of a large number. Some serve for food; some fall in places unfavorable for their growth; others are fragile, and rot before they find a suitable home. Life is very persistent, however, in some seeds: grain found in the hand of an Egyptian mummy sprouted and matured when transferred to proper soil.

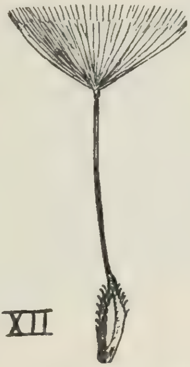


FIG. XII

Dandelion fruit with pappus, enlarged.

THE FRUIT.

The fruit of a plant is the ripened ovary with its contents. But what are usually called fruits consist of much more than this: for instance, the core is the actual fruit of the apple, while the part that we enjoy is the thickened, fleshy calyx.

Fruits are:—

Simple, when one ripened ovary forms a single fruit, as the apple. Simple fruits may be *fleshy*, — berry, cranberry; gourd, squash; pome, apple; stone fruit or drupe, peach, etc.; *dry*, achene, buttercup; utricle, pigweed, etc.; grain, wheat; nut, chestnut; key-fruit, maple; pod, pea, etc.

Compound fruits are really collections of simple fruits, as the mulberry and pineapple.

The *cone* is the peculiar collective fruit of many evergreens, as spruce, pine, etc.

FLOWERLESS OR CRYPTOGAMOUS PLANTS.

This division of vegetable life is extremely interesting: some of its best known members are ferns, mosses, moulds, dry-rot, potato-rot, seaweed, and the green scum of stagnant pools. As they have no flowers, these organisms are not propagated by seeds, but by *spores*, or those "hidden" modes of union which have given the name of cryptogams to this part of the vegetable kingdom. The highest in the scale of flowerless plants are the ferns and club-mosses. Among the lowest are the *protococcus nivalis*, a simple cellular plant, which produces the "red snow" of the arctic regions, and the yeast-plant.

Other *protococci* produce diphtheria and small-pox, and still another gives the green coloring often seen on city door-steps. The phenomenon of "bloody bread," which sometimes alarms the housekeeper in hot seasons, is due to one of these little organisms, which grows with great rapidity. The germs of moulds which appear on cheese and bread are floating everywhere in the air, but find moisture best adapted for their growth: hence the air of the storeroom should be kept dry and fresh.

The Pacific slope is rich in ferns, and is the home of more than sixty species: it is hoped that the edible fungi called truffles may be found in that region. They grow underground, near oak-trees; and as they are esteemed a great delicacy, the discovery would open a new industry.

Mushrooms, too, are cultivated to a great extent in Europe, especially in France, and might be here. They depend on a damp ground and moist atmosphere.

Fungi of immense size and strange shapes are said to have been found in a long-unused Nevada mine. Most of them were pure white, and unlike any to be seen above the ground. A fungus which grows in mines sometimes gives out light. The careful study of the lower forms of flowerless plants requires patience, skilful and delicate manipulation, and the aid of the microscope; but, when the problems presented by these perplexing organisms shall be solved, the results will be of incalculable benefit to the world. Through the knowledge thus gained, the failure of crops from the ravages of harmful rot may be averted, and epidemic diseases be prevented or arrested.

LONGEVITY OF PLANTS.

The lives of plants vary from the short existence of some moulds, whose growth and perfection we can watch, to the great trees over whose heads thousands of years have rolled.

Flowering plants are of two sorts, — those of *limited* and those of *unlimited* life.

The former are: —

Annuals, which start from the seed, blossom, bear fruit, and die in one season, as the nasturtium. In text-books of botany, the sign ① is used for an annual.

Biennials, ② which grow without flowering the first year, flower, bear fruit, and die the second season, as the candytuft and houstonia.

Those plants which live and grow for many years, and at last bloom once and die, as the American aloe.

Those of unlimited existence are called *Perennials* ♃ and live on, many of them, for a very long time, blossoming and bearing fruit each year, and die only from accident or old age. To this class belong our trees and many field and garden plants, as the buttercup, wild columbine, and peony.

The following approximate figures are given by an English authority as to longevity: —

Fig XV

Cone bearing branches of the Coniferæ

Boabab-tree of Senegal	5,150 years.	Deciduous cypress	6,000 years.
Oak	1,600 "	Ash	400 "
Ivy	600 "	Larch	270 "
Orange	1,500 "	Pear	260 "
Apple	80 to 175 years.		

The ash is full-grown in one hundred years, the elm in one hundred and fifty, and the oak in two hundred.

CONIFERÆ OR CONIFERS (Cone-Bearing Trees — the Pine Family).

Among the coniferæ or cone-bearing trees (Fig. XV.) are found some of colossal bulk and extraordinary height. The Douglas spruce ranges from one hundred and fifty to two hundred feet in height; and Humboldt and Herschel mention the discovery of fossils of them two hundred and forty-five feet in length, with a girth of fifty-seven and a half feet.

A section of the tide-land spruce shown in the Philadelphia Exhibition was cut from a tree three hundred and eighteen feet high, with a diameter of sixteen feet at the but; and the State of Oregon exhibited sections of the white fir from a tree three hundred and twenty-one feet high, with a diameter of five feet ten inches at two hundred feet from the ground. Oregon also exhibited a section of red cedar twenty-two feet in diameter, cut from a tree three hundred and twenty-five feet high, at a distance of one hundred and eighteen feet from the roots.

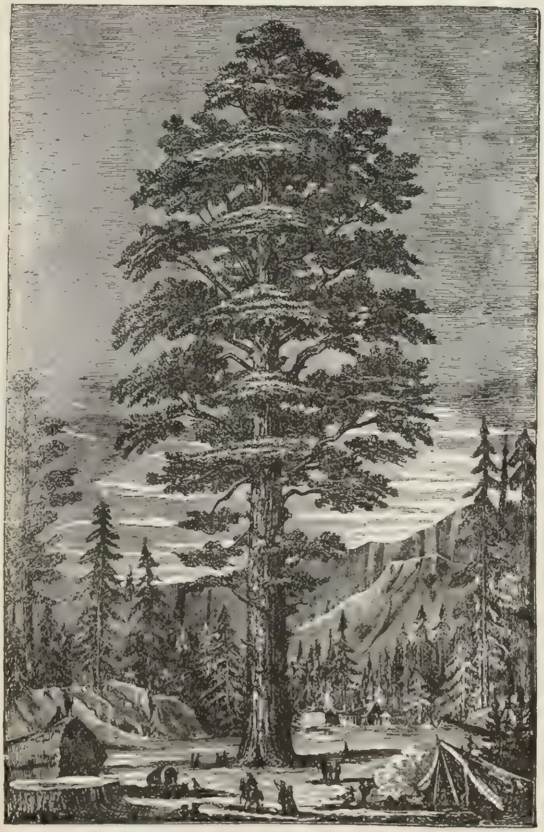


FIG 14. — The Mammoth Tree of California.

The largest tree of which we have any record is broken at a point three hundred feet from the ground, and measures, at the broken end, eighteen feet in diameter.

The largest coniferous trees in the world are found in the *Sierra Nevada.* In Europe they are less colossal, but are large when compared with other forest trees. The Austrian pine and larch reach a height of one hundred and twenty feet, and the English yew has been measured fifty-six feet six inches in girth. The most diminutive pine known is the Dacrydium taxifolium, averaging only six to ten inches in height.

It has been estimated that the *mammoth* tree of California (Fig. 14) has lived four thousand years; while the celebrated Taxodium of Chapultepec, in Mexico, is inferred to be over five thousand years old.

The Pinus Sylvestris, or Scotch pine, is said to require two hundred years' growth for its timber to reach maturity.

The ages of trees are generally determined by their rings of growth, though these are not in all cases trustworthy guides, some having been found to be biennial as well as annual. The hardiest trees on earth are found among the coniferæ, their growth only ceasing with vegetation at the confines of the arctic regions. Where the climate is too rigorous to allow their growth as trees, they go beyond their natural limits as low-creeping bushes. A pattoniana, a tree one hundred and fifty feet in height, dwindles to a shrub but four feet high on the summit of the Mount Baker range in North Carolina. The junipers are the most hardy of all coniferous trees, extending through cold regions far beyond the limit of trees.

The coniferæ supply a larger proportion of the timber used than all other forest trees together. The fir, pine, and cedar are the most valuable and durable.

The wood of the yew-tree is the most intrinsically valuable of the coniferæ. It is compact, hard, of fine and close grain, and will take a high polish.

Many of the seeds of the coniferæ are edible, the seeds of the stone-pine in Italy being made into cakes; and those of the Auracaria form the principal diet of the Indians of Chili, while the bark of the Sylvestris pine is often made into bread by the Norwegians. The juniper berry is used in medicine, and also for flavoring gin; while the larch is used for tanning. The coniferæ also produce gums, resins, amber, balsams, creosote, and frankincense.

MOVEMENTS OF PLANTS.

The movement of sap and bending toward the light may be considered as belonging to most plants, while some possess peculiarities of motion.

Many plants "sleep" at night, — some by closing the flower, as the crocus; others, as the clover, by folding the leaves. Tendrils describe circles, sometimes with rapidity, but usually too slowly for the process to be noted.

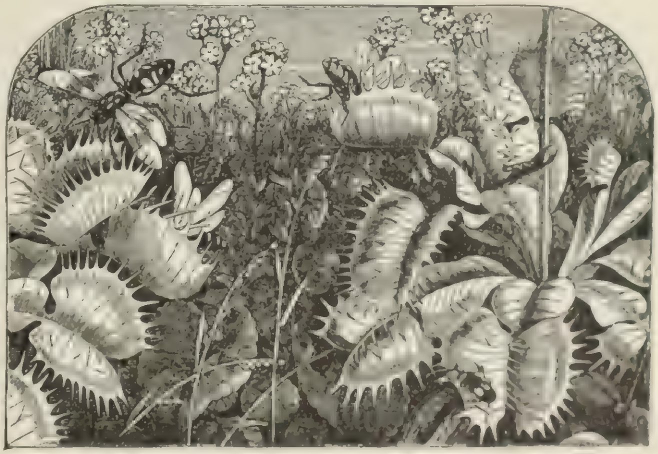


Fig. 13. — The Venus's Fly-Trap.

The Venus's Fly-trap (Fig. 13), which grows in North Carolina, and its relative the sundew, have curious appendages for catching insects. When one alights at the top of the leaf, the trap instantly closes, and the little prisoner seems to serve as food for his curious captor: there are other forms, too, of these, some of which have been noted by Tyndall and other authorities, arranged in different ways to capture insects, apparently for the same purpose, though this is disputed; but no other plausible reason has been given.

The sensitive plant gets its name from its irritability: its leaves close over one another if the plant is disturbed; nor is it known why it cannot bear to be touched. The stamens of the barberry, if touched on the inner side at the base, will bend quickly forward. An East Indian tree continually raises and lowers its leaves by a succession of jerks. Recent investigation seems to show that tree-trunks regularly expand and contract at short intervals.

A curious form of motion is that of the *rose of Jericho*, which blows about as a little dry ball, until the wet season affords sufficient nourishment for it to expand into a plant. Some of these movements seem to have a useful purpose, as the circular motion of tendrils moving toward or around a support.

DISTRIBUTION OF VEGETATION.

Vegetation is scattered with a liberal hand over the earth: even in the extreme northern region, mosses and lichens are found, upon which animals feed. As a rule, vegetation attains its greatest size, as well as richest profusion, within the tropics, and decreases in bulk and variety as it approaches the poles. There are exceptions: for instance, many arctic seaweeds are of far greater size than their tropical relatives.

The simplest organisms are the most widespread. There is no one flowering plant which is universal; but weeds and a few common flowers, as the marsh-marigold, are widely distributed. Some plants disappear from the vicinity of cities, as the mayflower and savin-tree, while others grow more luxuriantly near the homes of men, as nettles, burdock, and plantain.

Among the common plants which are indigenous to our country are maize, tobacco, laurel, and mayflower. Goldenrod and asters are found in the greatest number and variety in the United States. The magnolia attains perfection in our Southeastern States; the acacia, in Australia; the hyacinth, in Holland; and the cinchona, from which Peruvian bark is obtained, grows only upon the Andes. Roses do not grow south of the equator. Soft wood, as the pine, grows at a much greater height above the sea level than does hard wood; and, long after even the stunted evergreens disappear, mosses and lichens cling to the mountain-sides at very high altitudes.

Below is given the original home of a few of our familiar plants: —

Rye and Wheat	Tartary.	Rose	India.
Peach and Walnut	Persia.	Heath	Cape of Good Hope.
Apple	Britain.	The Vine	Asia.

Sugar-cane, brought to Spain by the Saracens.

The *orange* is thought by some to be a native of tropical America, while other authorities consider Asia its original home.

Arrow-root is a South American plant, the roots of which, bleached and pounded, are used as food. *Vegetable butter* is the useful, oily product of a South American tree. The *cow-tree* is another South American plant, which secretes an abundant milky juice. *India-rubber* is the juice of another tree of the same country.

Bamboo, in the East, grows from fifteen to sixty feet high, and is used in many ways, — for furniture and building purposes, and for masts and yards of ships. The young shoots and the seeds are eaten as delicacies. It has been suggested that bamboo culture be attempted in the Pacific States.

Cork is a part of the bark of the cork-oak of Spain, which is now successfully grown in Georgia.

Litmus, *cudbear*, and *archil* are produced by as many different *lichens*.

The juice of the Manchineel was used by the Indians to poison arrow-points.

A plant of our Western prairie, called Rosin-weed or Compass-plant (*Silphium laciniatum*), turns the edges of its leaves so faithfully north and south as to be useful as a guide to travellers.

In the South of France the oil derived from grape-seed is used for illuminating purposes.

Cloves are the unopened blossoms of the clove-tree. *Cassia-buds* are, as the name implies, the unripe buds of the cassia-tree, a near relative to that which produces cinnamon bark.

The *nutmeg* is the kernel of the fruit of the nutmeg-tree. *Mace*, which is yellowish red when fresh, is the *aril*, or loose bag, that surrounds the nutmeg. *Sago* is the granulated pith of the sago-palm of the East Indies.

One of the food trees of India is particularly useful: not only is the fruit edible, but the fleshy corolla is also extensively used as food. By a wise provision of the Almighty, the excessive heat of tropical countries, which renders active work almost impossible, makes food-plants grow luxuriantly without cultivation; and an entire family can live upon the products of a few cocoanut and bread-fruit trees.

A curious Australian tree, the Eucalyptus, may perhaps be of vital interest to the United States some day. This tree absorbs an enormous amount of moisture; and it has been suggested that malarial districts, particularly the Connecticut Valley, be planted with Eucalyptus-trees, in the hope that enough injurious moisture may be absorbed to prevent the progress of malaria.

By careful cultivation of plants from offshoots, the banana and some species of the vine and orange are rendered SEEDLESS; hence the seedless oranges and raisins sometimes in the market.

THE SUNFLOWER.

No flower has been for a long time more personal or more popular than the sunflower. It has grown in our favor, and is found in our gardens and homes, and is being imitated in infinite ways in jewelry, cards, and in the decorative arts.

The GOLDEN FLOWER, in botany, has nearly fifty varieties, and among the best known are the tall sunflower of Mexico and Peru; the perennial, its home being in Virginia; and the dwarf sunflower, brought lately from Egypt. The Jerusalem artichoke also belongs to this genus.

The stem and flowers, when burned, make a good potash. A bushel of the seed will make a gallon of oil nearly equal in value to olive-oil. It is used a great deal as food for poultry and for cattle. During the late unpleasantness, sunflowers were used in the South as a substitute for coffee. The *inside* of the *seed* tastes like sweet almond. In Portugal, they are used for bread. And during the late civil war in Spain, the Carlists prolonged the contest, and kept the wolf, starvation, from the door, some time longer by its judicious use.

In Spain and in Mexico it grows to the height of twenty feet, with flowers over four feet in diameter, and having more than three thousand seeds.

In Persia and in the Eastern lands there are many poetical allusions to the flower that always turns its face toward the sun; and there it is the emblem of constancy.

The poet Moore, full of Eastern traditions, thus uses it as such a picture of constancy when he says: —

> "As the sunflower turns on her god when he sets
> The same look which she turned when he rose."

Darwin says: —

> "It climbs the upland lawn,
> And bows in homage to the rising dawn."

It was dedicated long ago to St. Bartholomew, to St. Louis (king of France), also to St. Atrandis, and has its apostle at the present time. The sunflower was a sacred flower among the Peruvians, who worshipped the sun. Their virgins, who officiated in the "Temples of the Sun," were crowned with sunflowers made of pure gold, carried them in their hands, and fastened their robes with them. Thus we get a glimpse of the prosperous and advanced condition of the former inhabitants of Peru, before they were despoiled by the invaders, and before the conquering white man crossed their threshold

The Southern Indian says the sunflower, culled at sunset with a wish, brings the wish before the next sunset. Nor will the Southern negro allow to be brought into the house a broken one, or one pulled before it is ripe; and no true Texan will neglect to have it represented in his garden.

There is in New York a club of young ladies who call themselves "Sunflowers," and a county Sunflower in Northern Mississippi, with a Sunflower River running through it.

THE GARDEN.

The earliest garden flowers are from bulbs, — the crocus, snowdrop, jonquil, and tulip. It is a curious fact that the prevailing colors of spring flowers are white and yellow, and, as the season advances, the brighter, richer colors prevail.

If but little care can be given to the garden, *select hardy plants*, which need only judicious planting and moderate attention and they will bloom for years, often without resetting. A good soil should be provided, and the beds must be kept free from weeds. *Lilies of various sorts*, phlox, dicentra spectabilis, comfrey, peonies, with flowering almond and golden currant, as shrubs, will, with slight care, keep the garden brilliant with blossoms all the season. The sunflower should not be omitted from the list; for, besides its beauty, it is of value in absorbing injurious moisture from atmosphere and soil. Hardy species of roses should also find place, for rose culture is one of the most fascinating features of amateur gardening.

The thrifty housekeeper will not neglect to have a part of the garden reserved for the growth of *herbs*, which she would otherwise have to buy: lavender, marjoram, sage, thyme, parsley, and others have value in the domestic economy.

The garden culture of pears, apples, quinces, and small fruits is an interesting occupation, which well repays the care spent upon it. A small vegetable and fruit garden may be made to yield a supply of radishes, celery, beans, currants, peas, grapes, and strawberries for the family table. *In planting seeds* for the vegetable garden, be sure that they receive the proper amount of moisture; that they are sown at the right season, and so receive the required degree of heat; that the soil is sufficiently light, and the seed placed near enough to the surface to allow the young plant to reach the light easily.

The most frequent cause for failure in raising forest trees from seed is that the seeds are too dry. They should be kept moist, or at least never allowed to become dried.

Among the trees whose value has been but recently recognized is the Western catalpa; its rapid, symmetrical growth recommends it for ornamental planting, and as timber its wood has great durability.

FORESTS.

The importance of forests in preventing floods, and equalizing the rainfall and temperature of a country, is just beginning to be felt in America. Laws for forest preservation are very strict in Germany; and France is learning to cherish carefully her extent of woodland, with great benefit to herself. Although our country is still in some sections abundantly wooded, agriculturists are wisely giving attention to the planting and perservation of forests.

PRESERVATION OF FLOWERS, LEAVES, AND FERNS.

Specimens for preservation may be brought from the woods in a tin box, or they may be arranged on the spot in a press made as follows: Procure two pieces of coarse, stout wire-netting about 10 × 16 inches; cut a quantity of absorbent paper (as filter paper), and common newspaper, the size of the netting, and have straps to bind the whole firmly together. Place a specimen between layers of filter paper, and separate each two specimens by layers of newspaper; use the wire for covers, and strap securely. If the paper is sufficiently porous, the specimens, unless very delicate, will keep in condition with no change of paper. It is better, however, to have the paper changed frequently at first, to extract all the moisture from the flowers.

For mounting, use thick, white paper, cut the size above given. Fasten the parts of the plant upon it with narrow strips of gummed paper, or directly by means of gum-arabic water; one plant only should be put upon a page. Each specimen should, if posssible, consist of the flower, a portion of the stem with leaves, and the root, or a section of it.

Covers of brown paper should be made, into which all specimens of one genus may be slipped.

Leaves and *ferns* may be preserved for ornament merely by drying in papers under a heavy pressure, or in the netting press above described; or leaves may be sometimes successfully dried by ironing with a warm iron which has been passed over a cake of wax. They may be effectively used, with dried grasses, as bouquets and wall decorations.

If a choice of windows can be had, a southern exposure is preferable, for in that case the plants can have sun all day; but almost any window may be utilized, as many plants require no direct sunlight.

Fitting. — The simplest fitting is a shelf six or eight inches wide, supported about six inches below the sill by iron brackets. It is well to run strings or an adjustable ivy-trellis from pots in brackets, or at either end of the shelf, to meet at the centre of the window, so that the climbing plants may form an arch. Shades are absolutely necessary, and should be drawn every night to keep the plants from severe cold.

Common clay pots are best, because they are porous and so allow of side drainage: this prevents the soil from souring, as it will when no air can reach it, as in a glazed or painted pot. Fancy adjustable pot-covers may be bought, which slip over the clay pots. Unless the shelf or stand has sides and a system of drainage, each pot should have a saucer to catch the superfluous water; but water should not be permitted to stand in a saucer unless the room is very hot and the plant is in danger of wilting.

Soil suitable for potting may be bought of any florist, or the following is a good mixture for most house-plants: One part sand, one part leaf mould, one part manure, one part peat, two parts turf or garden mould. Lacking leaf mould, substitute one extra part of manure; lacking peat, substitute one extra part turf mould. The soil must be sufficiently light and porous to permit the free circulation of air.

Temperature. — A thermometer should stand in the shade in the window-garden; the mercury should not fall below 40° at night, and 60° by day.

Sun. — Strong sunshine is unnecessary for all plants; so those which require the most should be placed nearest the glass, taking care that no large plant shall deprive a smaller one of its needed sunlight.

Water. — Examine the plants every day, but water only when the soil is dry and light. The water should be about the temperature of the room. Sprinkling cleanses the leaves and keeps them free from dust, which would clog the breathing-holes. Plants need plenty of fresh air.

Trimming. — To prevent a tall, scraggy growth, cut off the top of the plant, or pinch off the upper buds as fast as they appear, until the plant has attained the desired shape. Pinching and trimming are used to insure full and rich flowers by keeping the plant from blossoming too soon.

Plants always lean toward the strongest light; and it is a mistake to turn them in the hope of obtaining symmetrical growth, as they are only weakened and distorted by constantly trying to reach the light.

Frozen plants should be removed from the light and kept rather cool. Cut off the blackened parts and sprinkle the plants thoroughly. Continue this treatment until it puts forth new buds, when it may be gradually restored to its former share of warmth and sunshine.

Insects. — As a preventive from insects, keep the air of the room moist by the evaporation of water in pans on the furnace or stove. The plant-stand may have a rim two or three inches deep, and be zinc-lined; then the space between the pots may be filled with moss, which will assist in keeping the atmosphere moist; the common gray moss, which holds water like a sponge, is excellent for the purpose. To destroy most insects which infest window-gardens, the plants may be put into a barrel or large box and smoked with tobacco, taking care that the plants do not get too hot. The dead insects may then be washed off by sprinkling.

Seeds and Slips. — Sow the seeds evenly in a fine soil; just cover with earth, and keep them shaded until the little plant appears. Then place in the sunshine, and do not water them too abundantly. Transfer to small pots when they are about two inches high. Slips should be rooted in sand, watered generously, and kept shaded and cool.

Hyacinths and *other bulbs* may be planted in light, sandy soil, and kept in a cool, moist, dark place, with scanty watering until the roots have grown strong; they may then be forced into bloom by warmth and sunshine. Hyacinths may be cultivated in glasses, care being taken that the bulb does not touch the water.

IVY, as a house-plant, requires a large pot; the plant and the pot should be shaded. The leaves must be kept clean, and the whole plant plentifully watered. This is the care which is given ivies in beer saloons and gardens, where they flourish in a most satisfactory way.

These may be successfully raised from the seed: Mignonette, candytuft, wall-flower, petunia, lobelia; and these climbers: tall nasturtium, canary-bird flower.

OTHER PLANTS FOR WINDOW-CULTURE.—*Requiring sun. Hardy:* Azalea, chrysanthemum, carnation, cyclamen, geraniums, oleander. *Tender:* Begonia, bouvardia, calla, heliotrope; and the foliage plants, coleus, German ivy, and artillery plant.

Those not requiring sun: Camellia, tradescantia, ferns, English ivy, lycopodium, primrose, pansies, violets, dracæna.

LANGUAGE OF FLOWERS.

> "'T was a lovely thought to mark the hours,
> As they floated in light away,
> By the opening and the folding flow'rs
> That laugh in the summer's day." — HEMANS.

ACACIA, ROSE	Friendship.
ADONIS	Sad memories.
ALMOND, FLOWERING	Hope.
ALYSSUM, SWEET	Worth beyond beauty.
AMARANTH, GLOBE	Unfading love.
ANEMONE, FIELD	Sickness.
APPLE	Temptation.
" BLOSSOM	Preference.
ARBOR-VITÆ	Unchanging friendship.
AURICULA, SCARLET	Avarice.
AZALEA	Temperance.
BACHELOR'S BUTTONS	Celibacy.
BALM OF GILEAD	Cure. Relief.
BALSAM, RED	Touch me not.
BARBERRY	Sharpness.
BAY LEAF	I change but in death.
BAY WREATH	Reward of merit.
BELLADONNA	Silence. Hush!
BILBERRY	Treachery.
BLUEBELL	Constancy.
BLUEBOTTLE	Delicacy.
BOX	Stoicism.
BRAMBLE	Envy. Remorse.
BRANCH OF CURRANTS	You please all.
BRIONY	May you prosper.
BROKEN STRAW	A quarrel.
BURR	You weary me.
BUTTERCUP	Childishness.
CAMELLIA (white)	Perfect loveliness.
CANDYTUFT	Indifference.
CANTERBURY BELL (blue)	I love thee still.
CAPE JASMINE	Ecstasy.
CARDINAL FLOWER	Distinction.
CARNATION (striped)	Refusal.
" (red)	A blush.
CELANDINE	Joys to come.
CHINA ASTER (single)	I will think of it.
" " (double)	I partake of your sentiments.
CHRYSANTHEMUM (red)	I love.
" (white)	Truth.
" (yellow)	Slighted love.
CLEMATIS	Mental beauty.
CLOVER (red)	Industry.
" (white)	Think of me.
COLUMBINE (red)	Anxious.
CONVOLVULUS	Bonds.
COREOPSIS	Always cheerful.
CORN	Riches.
COWSLIP	Winning grace.
CRANBERRY	Cure for heartache.
CROCUS	Abuse not.
CROWN IMPERIAL	Majesty.
CYCLAMEN	Diffidence.
CYPRESS	Death. Mourning.
DAHLIA	Instability.
DAISY (white)	Innocence.
DANDELION	Love's oracle.
DEAD LEAVES	Sadness.
DEWPLANT	A serenade.
DOCK	Patience.
DOG'S-BANE	Deceit.
ELDER	Compassion.
EVENING PRIMROSE	Inconstancy.
EVERLASTING	Never-ceasing remembrance.
FERN	Sincerity.
FILBERT	Reconciliation.
FORGET-ME-NOT	True love.
FOXGLOVE	Insincerity.

Fuchsia (scarlet)	Taste.
Gentian	Virgin pride.
Geranium, Apple	Present preference.
" Fish	Disapp'ted expectation.
" Nutmeg	An expected meeting.
" Lemon	An unexpected meeting.
" Scarlet	Comforting.
" Rose	Preference.
" Silver-leaf	Recall.
Gillyflower	Bonds of affection.
Goldenrod	Encouragement.
Gooseberry	Anticipation.
Grass	Submission.
Harebell	Grief.
Hawthorn	Hope.
Heath	Solitude.
Heliotrope	Faithfulness.
Hepatica	Confidence.
Holly	Am I forgotten ?
Honeysuckle	Devoted affection.
Houstonia	Content.
Hyacinth (blue)	Constancy.
" (purple)	Sorrow.
" (rose)	Enthusiasm.
" (white)	Unobtrusive loveliness.
Iris	Message.
Ivy	I cling to thee.
" Spring (with tendrils)	Assiduous to please.
Japonica (red)	My heart bleeds for you.
Jonquil	Affection returned.
Kingcup	I wish I were rich.
Laburnam	Forsaken.
Lady's Slipper	Fickleness.
Larkspur	Levity.
Laurel, Mountain	Ambition.
Lemon-Blossom	Fidelity in love.
Lilac (white)	Modesty.
" (purple)	First emotion of love.
Lily of the Valley	Return of happiness.
Lily, Water	Silence.
Love-in-a-Mist	Perplexity.
Magnolia	Love of nature.
Maidenhair	Discretion.
Mallow, Marsh	Sweet disposition.
Mignonette	Your qualities surpass your charms.
Mint	Virtue.
Mistletoe	I surmount difficulties.
Morning-Glory	Affectation.
Myostis	Forget me not.
Myrtle	Love in absence.
Narcissus	Self-esteem.
Nasturtium	Patriotism.
Oak-Leaf	Bravery.
Oleander	Beware.
Olive	Peace.
Orange-Blossom	Marriage festivities.
Orchis	A beauty.
Pansy and Heart's Ease	Thoughts.
Passion Flower	Belief.
Peach-Blossom	I am your captive.
Pea, Sweet	Departure.
Pink (white)	Talent.
Pomegranate	Mature elegance.
Poppy (red)	Consolation.
Primrose	Early youth.
Rhododendron	Danger.
Rose, Bridal	Happy love.
" China	Beauty always new.
" Damask	Brilliant complexion.
" Deep Red	Bashful love.
" Full-blown, placed over two buds	Secrecy.
" Single	Simplicity.
" Wild	Romance.
" Yellow	Jealousy.
" (red, half-blown)	Love.
" (red, withered)	Loved and lost.
Rosebud, Moss	Confession of love.
" (white)	Girlhood.
Rosemary	Remembrance.
Rudbeckia	Justice.
Sage	Esteem.
Sensitive Plant	Sensitiveness.
Snowdrop	Hope.
Solomon's Seal	Mystery.
Southernwood	Jest.
Sunflower	Haughtiness.
Sweet-William	Gallantry.
Syringa	Memory.
Tansy	I declare war against you.
Tuberose	Voluptuousness.
Tulip (red)	A declaration of love.
" (variegated)	Beautiful eyes.
" (yellow)	Hopeless love.
Verbena (white)	Pray for me.
Violet (blue)	Faithfulness.
" (sweet)	Modesty.
" (yellow)	Rural happiness.
Wall-Flower	Fidelity in misfortune.
Weeping Willow	Mourning.
Witch-Hazel	A spell.
Woodbine	Fraternal love.
Wormwood	Absence.
Yarrow	Thou alone canst cure.
Yew	Sadness.
Zinnia	Thoughts of absent friends.

NATURAL HISTORY.

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NATURAL HISTORY, in its entirety, is a description of the vegetable, mineral, and animal products of the earth; but in the restricted sense in which it is popularly used, it is synonymous with Zoölogy, or is simply a treatise upon animal life. In this sense we use it here, the vegetable and mineral kingdoms, and the fossil animals, having been treated separately in this work under the heads, Vegetation, Mineralogy, Metallurgy, and Geology.

Many persons recommend students to commence this study by making independent investigations or examinations of individual animals; but we believe that he who would make any considerable progress in this science should first make himself acquainted with the results of the lifetime studies of the great naturalists, at least to the extent of learning the system of classification of the greatest of them all, — Agassiz.

Nothing whatever is gained by the simple discovery, or supposed discovery, of a new species or genus of animal, unless the study of it has been so complete as to fix its position in one of the subdivisions of the principal types or departments.

All the great naturalists have been forced to make some sort of regular subdivisions in order to have an intelligible record of the results of their special studies; but their classifications have been arbitrary, formal, diverse, and perplexing to themselves as well as others, and for the reason that they used the same terms in different senses, and with no definite idea except that one should include another, yet without any specific reason why one should be higher or the other lower in the scale, in divisions above the *genus* (the group next the lowest).

Different specialists have taken totally unlike bases for their chief divisions. Thus, some have made the animal organization, with respect to its adaptation to the element or elements in which the animal lives, the essential distinguishing characteristic; others have considered the animal form, its geographical range, or its general external appearance, the typical character; but while they failed in general classification, they rendered invaluable service in some particular branch: as, Linnæus in the introduction of *orders;* Latreille in the study of *genera;* Cuvier in discovering that the sub-kingdoms are distinguished by their different plans of structure; and Von Baer in showing that all animals are produced from eggs.

It remained for Agassiz to bring order out of confusion, and system into animal classification, by his wonderful capacity in reading the designs in Nature, and basing his system upon her discovered laws instead of upon arbitrary forms which might at first seem more regular, but would not bear the test of critical study.

Agassiz's system is now generally acknowledged the true one; yet, errors are still made by naturalists lacking the judgment of the great organizer in recognizing the actual differences between *homologies* (likeness of structure) and *analogies* (likeness in use) of animal parts or organs.

We shall briefly give an epitome of Agassiz's generalizations and reasons for making them.

His system is based upon an *affinity*, *homology*, relationship, between the organs of the body, which are constructed on the same *plan*, though they may vary in *form*, or have different *uses;* and it discards *analogy*, or similarity of functions or uses of these organs, as a means of general classification. Thus, in considering the classes of vertebrates, if we were to make our divisions in accordance with the uses to which the wings of birds and bats are put, *analogy* would force us to include bats in the class of birds; but their structure being unlike, *homology* requires them to be placed in different classes; and likeness of structure causes bats to be included in the class of mammals. Likewise, while the wings of birds and butterflies serve the same purpose, these animals and their wings have a very different *plan of construction*, hence are assigned to different departments; but birds and monkeys—their wings and hands—have the same foundation *plan* of construction and are included among the vertebrates.

Having determined that the principal divisions of animals naturally depend upon the *plan of their construction*, Agassiz found that, by close and careful analysis, he had arrived at the same conclusions to which Cuvier and Von Baer, each pursuing the subjects from different points of view, came; viz., that the ANIMAL KINGDOM is divided into four *sub-kingdoms* or departments or branches or types: *Vertebrata*, *Articulata*, *Mollusca*, and *Radiata*.

The VERTEBRATA are distinguished not only by the universal presence of a back-bone or spinal cord and a skull, but by the general plan of structure, which exhibits a cavity above and one below a solid axis, the upper of which contains the vital organs and nerve centres, while the lower is the receptacle for the organs of assimilation and reproduction. *Man* is an example; and all mammals, birds, reptiles, and fishes belong to this type.

The ARTICULATA are known from the construction of their bodies, which are formed in rings or joints, as the crab, lobster, insects, and worms.

The MOLLUSCA are recognized by the fact that they have soft bodies with no internal skeleton, but with a single cavity; and are encased in a shell covering, from which nerves extend to various parts of the body, the shell being double, as in the oyster, or single, as in the snail.

The RADIATA are so designated because their organs of sense and motion radiate from and around the centre, as in the star-fish, sea-urchin, jelly-fish, and polyp.

Within these respective types or departments, naturalists have long made subdivisions into *classes*, *orders*, *families*, *genera*, and *species*, but have ever differed in their order of descent from the sub-kingdoms, because there were no standard definitions of these terms. Agassiz arranged these divisions in their natural order, as in this paragraph, and sharply defined them in applying the proper terms.

The SUB-KINGDOMS, based upon the *plan* of construction, naturally present various *phases*, resulting from the different methods of execution of the general plans, as birds and mammals among the vertebrates; and these phases are natural divisions, in accordance with the ways and means which diversity of structure provides for maintenance of life, marking CLASSES.

These *classes* have varying *degrees of complexity in structure*, which in a measure determines the mode of life; as, for instance, flesh-eaters (*Carnivora*) and grass-eaters (*Herbivora*), natural ORDERS among *Mammals*, since the execution of their general plan of structure is such as marks that class.

These *orders* include animals which, while they have perhaps equal complexity of structure and similar modes of living, have, also, *peculiarities in some of their external parts*, their ultimate structure, or outward finish; as the lion, tiger, cat, etc., have the same structure of feet, claws, and teeth, but differ in these respects from the dog, fox, wolf, etc.; hence they are different kinds or *genera* of the same *order* (Carnivora), the former belonging to the *genus* Felis (cat), and the latter to the genus Canis (dog).

Sometimes several *genera* are much alike in *peculiarities of form* of structure, and then they are said to form a FAMILY, as crows, blackbirds, jays, etc., form the family called *Corvidæ* (crows); hence the *family* should be placed between the *genus* and the *order*.

The individual animals which have close relations to one another and to the surrounding elements, as regards color, size, habits, etc., form the lowest division, — SPECIES; as, different kinds or species of duck, or of squirrel, or of cat, one species varying from another in some comparatively trivial manner (yet plainly observable), while agreeing in general character and structure.

To recapitulate: —

1. *Departments* or *types* are determined by the general plan of structure.
2. *Classes*, by the manner in which the plan is executed, with reference to ways and means.
3. *Orders*, by the degrees of complexity of structure.
4. *Families*, by form as occasioned by structure.
5. *Genera*, by detail of execution in special external parts.
6. *Species*, by the relations of individuals to one another and their surroundings, as well as by their color, size, habits, and the proportions of their parts.

Says Agassiz: "In the same manner as the variations played by a most skilful artist upon the simplest tune are not modifications of the tune itself, but only different expressions of the same fundamental harmony; just so neither the classes, nor the orders, nor the families, nor the genera, nor the species of any great type, are modifications of its plan, but only its different expressions, — the different ways in which the fundamental thought embodied in it is manifested in a variety of living beings."

While the above-mentioned divisions are the principal ones, there are other natural subdivisions of certain orders, families, and genera; but they are not uniform in every class, and though some classes may have natural sub-orders, sub-families, sub-genera, or varieties of species, or even all these, others may have none.

It is for this reason that we use Agassiz's system of classification in preference to those of somewhat later date; for he never designates a subdivision unless he finds Nature has made it, and thus avoids the use of needless terms. The same principles governed him, and should govern all, in making subdivisions as in corresponding principal divisions; but most naturalists are inclined to note regularity of divisions, when the most trivial difference in species or genera can be found to excuse the act. The latest classifications which textbooks offer are modifications of Huxley's system, which is in great measure an English view of the old German systems based upon embryology, and with the evident purpose of establishing the theory of evolution from the lowest type, through the intermediate types, to the highest; that is, of gradual upward development from the lowest form of animal life.

It is a beautiful method of study (to begin with the embryo), but is misleading when made the sole basis of classification. In this brief article an extended consideration of embryology is out of the question; and we can only urge that whatever *similarities* may appear in the earlier developments of the embryo or germ of different classes of animals, they shall not be used in determining relationship of *types*, but that the *structure* of the matured animal shall be used as the basis.

If geology teaches anything, it is that the Articulates, Radiates, and Mollusks have a

DEPARTMENTS OR TYPES.	CLASSES.	ORDERS.*	FAMILIES.*	GENERA.*	SPECIES.*
1. VERTEBRATA. (Animals having a back-bone, and a cavity above and below a solid axis or division, with the vital organs and nerve centres in the upper, and the organs of assimilation and reproduction in the lower cavity.)	1. MAMMALIA. (Mammals.)	1. Carnivora (Mammals fitted for eating flesh).	Canidæ (dogs) Felidæ (cats).	Canis. Felis.	C. familiaris (dog); vulpes (fox), lupus (wolf). F. domesticus (cat); leo (lion), tigris (tiger).
		2. Herbivora (Mammals fitted for eating herbage).	Cervidæ (deer).	Cervus. Cariacus.	C. Canadensis (elk or wapiti). C. Virginianus (common deer).
		3 Cetacea (Mammals of the whale kind)	Delphinidæ (dolphins).	Delphinus.	D. delphis (common dolphin).
	2 AVES. (Birds.)	1. Incessores (Birds that perch).	Vulturidæ (vultures).	Vultur.	V. cinereus (gray vulture).
		2. Scansores (Birds that climb).	Piscidæ (woodpeckers).	Picus.	P. auratus (gold-winged woodpecker
		3. Grallatores (Birds that wade).	Scolopacidæ (snipes).	Scolopax.	S. gallinago (common snipe).
		4. Natatores (Birds that swim).	Anatidæ (ducks).	Anas.	A boschas (mallard duck).
	3. REPTILIA. (Reptiles.)	1. Rhizodontes (Large reptiles with hollow teeth, now nearly extinct.)			
		2. Lacertia (Lizards).	Crocodilidæ (crocodiles).	Alligator.	A. Mississippiensis.
		3. Ophidia (Snakes).	Viperidæ (vipers).	Vipera.	V. berus (common adder).
		4. Chelonia (Turtles); sub-order, Chelonii.	Chelonioidæ.	Chelonia.	C. imbricata (hawk's-bill turtle).
	†4. BATRACHIA. (Frogs and salamanders.)	1. Anura.	Ranidæ.	Rana.	Rana halecina (common frog).
		2. Ichthyodi.		Cryptobranchus.	C. Japonicus (Japanese salamander).
		3. Cæciliæ.	Cæcilidæ.	Cæcilia.	C. lumbricoides (slimy blind snake).
	†5. PISCES. (Fishes.)	1. Ganoidei (Fishes with enamelled scales).	Hyoganoidæ.	Lepidosteus.	L. osseus (bony gar-pike).
		2. Placoidei (Fishes with skin like shagreen).	Squalidæ.	Carcharias.	C. vulgaris (common white shark).
		3. Ctenoidei (Fishes with edge of scales toothed, and bony rays to fins).	Percoidæ.	Perca.	P. fluviatilis (river perch).
		4. Cycloidei (Fishes with scales entire and fin rays soft).	Salmonidæ (salmon trout & whitefish).	Salmo (salmon).	S. fontinalis (brook trout).
2. ARTICULATA. (Animals whose body is composed of rings or joints.)	1. INSECTA. (Insects.)	1. Suctoria (Insects with a trunk for sucking fluids).	Papilionidæ.	Papilio.	P. asterias (star butterfly).
		2. Manducata (Insects with jaws for dividing food).	Rutilidæ.	Areoda.	A. lanigera (woolly areoda or goldsmith's beetle).
		3. Aptera (Insects destitute of wings).	Arachnidæ.	Araneina.	Epeira vulgaris (common garden spider).
	2. CRUSTACEA. (Crustaceans.)	1. Malacostraca (Crustaceans protected by a shield).	Decapodæ.	Cancer.	C. irroratus (common shore crab).
		2. Entomostraca (Crustaceans not protected by a shield).	Copepodæ.	Cyclops.	C. quadricornus (four-horned, one-eyed water-flea).
		3. Trilobita (Crustaceans with three lobes to the body; now extinct).			
	3. VERMES. (Worms.)	1. Tubulibranchiata (Worms with thread-like gills about the head).	Geoplanidæ.	Rhyncodesmus.	R. sylvaticus (wood-land worms).
		2. Dorsibranchiata (Worms with gills placed along the sides).	Enteropneusta.	Balanoglossus.	B. aurantiacus (whale's-tongue worm).
		3. Abranchiata (Worms without exterior gills).	Annelidæ.	Lumbricus.	L. terrestris (common earth-worm).
3. MOLLUSCA. (Animals having a soft body, with a single cavity, and enclosed in a shell.)	1. CEPHALOPODA. (Those which have arms or legs about the mouth)	1. Teuthidoidea (Cuttle-fishes proper).	Loligidæ.	Loligo.	L. pallida (white loligo). L. argonauta (sailing loligo).
		2. Ammonitoidea (Cuttle-fishes with a shell divided into numerous chambers by sinuous partitions. Now extinct).			
		3. Nautiloidea (Cuttle-fishes with chambered shell divided by simple partitions).	Nautilidæ.	Nautilus.	N. pompilius.
	2. GASTEROPODA. (Those which creep on a flattened disk or foot.)	1. Pulmonata (Land snails which breathe air).	Colinacea.	Helix.	H. albolabris (common snail).
		2 Branchifera (Aquatic snails which breathe water).	Neritacea.	Natica.	N. heros (water-pot snail).
		3. Pteropoda (Snails with wing-like apparatus about the head, for swimming).	Spiralidæ.	Spiralis.	S. Gouldii (common New England snail).
		4. [illegible]	[illegible]	[illegible]	P. palustris (mud-ball snail).

		3. Abranchiata (Worms without exterior gills).	Annelidæ.	Lumbricus.	L. terrestris (common earth-worm).
3. MOLLUSCA. (Animals having a soft body, with a single cavity, and enclosed by a shell.)	1. CEPHALOPODA. (Those which have arms or legs about the mouth.)	1. Teuthidoidea (Cuttle-fishes proper).	Loligidæ.	Loligo.	L. pallida (white loligo). L. argonauta (sailing loligo).
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	2. GASTEROPODA. (Those which creep on a flattened disk or foot.)	1. Pulmonata (Land snails which breathe air).	Colinacea.	Helix.	H. albolabris (common snail).
		2. Branchifera (Aquatic snails which breathe water).	Neritacea.	Natica.	N. heros (water-pot snail).
		3. Pteropoda (Snails with wing-like apparatus about the head, for swimming).	Spiralidæ.	Spiralis.	S. Gouldii (common New England snail).
		4. Rhizopoda or Foraminifera (Snails of lower form, looking like polyps).	Amœba.	Pelomyxa.	P. palustris (mud-ball snail).
	3. ACEPHALA. (Those which have no distinct head, and are enclosed in a bivalve shell.)	1. Lamellibranchiata (Mollusks having shells in two parts; bivalves).	Asiphonidæ. Siphonidæ.	Ostrea. Mya.	O. edulis (common edible oyster). M. arenaria (common mud clam).
		2. Brachiopoda (Mollusks with two unequal valves, furnished with peculiar arms).	Lingulidæ.	Lingula.	L. pyramidata (mollusk living in sand tubes).
		3. Tunicata (Mollusks living in chains or clusters).	Thaliacea.	Salpa.	S. spinoza (spiny stock-fish).
		4. Bryozoa (Mollusks of a very low order on plant-like stems, like Flustra — sea-mats).		Halophila.	H. borealis.
4. RADIATA. (Animals having organs of motion and sensation arranged radiatingly around a centre.)	1. ECHINODERMATA. (Sea-urchins bearing spines upon the surface.)	1. Holothuroidea (Sea-slugs).	Synoptidæ.	Synopta.	S. Girardii (common sea-slug).
		2. Echinoidea (Sea-urchins).	Echinidæ.	Echinus.	E. drobachensis (common sea-urchin).
		3. Asteroidea (Free Star-fishes).	Asteridæ.	Asterias.	A. vulgaris (common star-fish).
		4. Crinoidea (Star-fishes mostly attached by a stem).	Brachiata.	Pentacrinus.	P. caput-medusæ (stone lily, with medusa head).
	2. ACALEPHA. (Jelly-fishes.)	1. Ctenophoræ (comb-bearers) (Jelly-fishes with vibrating hairs, for moving).	Bolindæ.	Bolina.	B. alata (transparent, diffusible jelly-fish).
		2. Discophoræ (The Medusæ, or common jelly-fishes)	Rhizostomidæ.	Rhizostoma.	R. corona (eight-armed, crown jelly-fish).
		3. Hydroidæ (Jelly-fishes, next in order above polyps).	Melicertidæ.	Melicertum.	M. campanula (bell-shaped hydra).
		Sub-order: Diphyæ (of the Siphonophoræ).	Prayidæ.	Praia.	P. dubia.
	3. POLYPS. (Animals fixed like plants to the ground, having a series of flexible arms around the mouth.)	1. Actinozoa (Fresh water and marine polyps)	Zoantharidæ. Alcyonidæ.	Actinia. Alcyonium.	A. metridium (com'n sea-anemone). A. carnum (common coral polyp).

* Only *examples* of sub-orders, of families, of genera, and of species have been given, it being impracticable to enumerate more in this table.

† See text, adjoining page.

distinct and equally ancient origin ; and example and analogy show the origin of Vertebrates to be equally independent, if not equally ancient.

Agassiz has given the strongest reasons for believing that the four sub-kingdoms have ever been distinct and coexistent.

The general division of *Infusoria* (so called because abundant in water infused with vegetable matter) may ultimately be, but is not, satisfactorily settled ; for many formerly supposed animals have been shown to be plants, and many others have been found to belong to one or other of the great divisions of the animal kingdom ; hence no place has been assigned in the table for the lowest forms of undetermined animals, generally designated *Protozoans.*

† The table is not to be understood as a perfected arrangement of even the chief divisions, but as illustrative of systematic classification, and as representative of Agassiz's definite conclusions regarding animals which had been thoroughly studied when his comparisons were made. No one knows better than he knew that a more complete knowledge of the characteristics of individual animals must cause a rearrangement of orders and classes, as is indicated by his later arrangement of Batrachia or Amphibia (two-lived animals) as a class instead of an order, and his suggestions that further investigation might show his *orders* of fishes to have those differences of structure which distinguish *classes,* the result of which would be four additional classes of Vertebrates; viz., Placoidei or Selachians (sharks and rays), Ganoidei (gars and pikes), Fishes proper (Ctenoidei and Cycloidei, as perch, trout, etc.), and Myzontes (hags and lampreys).

What technical name may be given to an animal or class of animals is of minor importance; but it is a matter of the greatest moment to zoölogy as a science that naturalists should agree in the plan of, and terms used in, classification. Until this is done, Agassiz's divisions as herein given may be considered the most simple and true to nature, notwithstanding the later and more particular information of living naturalists in relation to certain species. One of the most improving and recompensing modes of study is to take the best particular description of an animal and see how many naturalists give it the same classification, and then try to determine which one, if any, has placed it in accordance with the foundation principles enunciated by Agassiz.

Enlightened study of the development of the embryo or germ of animals leads to the same conclusions regarding the general plans of structure as hereinbefore specified, and negatives the theory of some naturalists that the higher forms of animal life are the result of development of the lowest forms, as a vertebrate from a radiate; and the theory of others that life is only a spontaneous generation or production of the physical forces of matter; that is, that the simple substances or elements, or any combination of them, or the disintegrated particles of compound substances, — as the mud resulting from the breaking or wearing into powder of granite or any other rock, — have the power in themselves to produce life.

All are forced to admit that every kind of animal life which has been so investigated as to furnish reasonable certainty of its origin comes from an egg, microscopic or otherwise, developed in the animal or after separation from it.

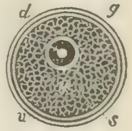


Fig. 1.

An egg is an organism or cell, more or less spherical, produced from glandular bodies or tissues, called *ovaries* in the abdominal cavity of animals; it contains a *vitellus* or yolk, *y,* which includes smaller cells and a germ vesicle, *g,* and dot, *d,* as shown in Fig. 1. The vitelline membrane, *v,* is that surrounding the yolk, and *s* is the shell membrane. Eggs vary in size and form, but all contain the life principle or germ vesicle.

No microscope can cause the differences which exist in these germs to become manifest to the human eye; in fact, no microscope can enable us to determine the kind of animal to be produced, even after parts of the animal are disclosed; but if we know what animal generated the egg, we can be certain of the kind of animal which will ultimately result; thus, if a vertebrate produce the egg, a vertebrate of the same species will appear; if an articulate or a mollusk or a radiate produce it, the like in kind, class, and type will be forthcoming.

Every animal undergoes certain metamorphoses from germination to maturity: some mostly within the mother, as in mammals; others after the hatching of the egg, as in the amphibia (see development of the frog, Fig. 21); and still others by *alternate generation* or series of transformations, in which apparently distinct animals occur, as in the parasitic worm, *Distomum*, which appears in four distinct forms; viz., *Larva*, *Radia* (parent-nurse), *Cercaria* (nurse), and *Distomum*, any one of which seen by the side of the other would seem a distinct animal; yet the last produces the egg from which the first comes, and which finally results in a Distomum. Still greater changes take place in the Aphides (plant lice); and the Hydroid Medusæ are wonders in the way of metamorphosis. Who would suspect, from their individual appearance (see Fig. 2, showing some of their forms), relationship between the plant-like stem and the free jellyfish; between the *Gastrula*, the *Scyphistoma*, the *Strobila*, the *Ephyra* and the *Medusa*, forms to which these names were given when they were thought to be distinct animals, and yet that Medusa produces the eggs which become the Gastrula, which in turn attaches itself to a rock or dead shell or sea-weed, and assumes in succession the above forms, ending with the Medusa.

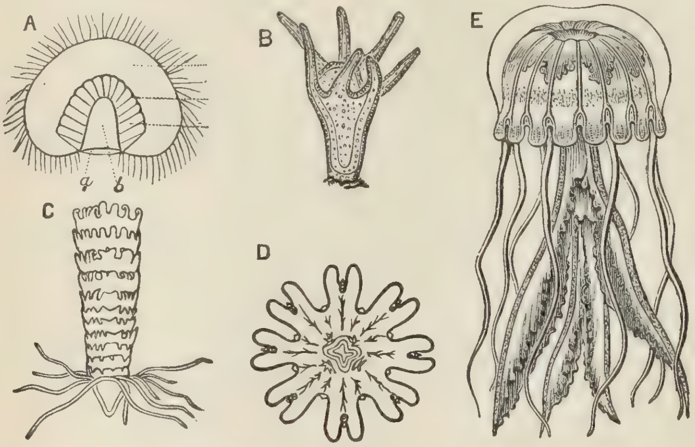


FIG. 2.

Showing the stages of development of the Jelly-fish (*Aurelia flavidula*). A representing the *Gastrula* form; B, the *Scyphistoma;* C, the *Strobila;* D, the *Ephyra;* and E, the perfected *Medusa*.

The essential difference between *metamorphoses* and *alternate reproductions* would disappear, if animals subject to metamorphosis were to die in producing the new forms; for example: the frog and the butterfly would be perfected by reproductions, if the tadpole and the caterpillar were to die after the one had produced young frogs and the other young butterflies; but the offspring would be of the same species then as now (though two or more acts of generation would take place instead of a continuous transformation of the same young animal), and the general principle of reproduction from an egg would remain the same, for the intermediate forms would be only distinct stages of growth from the egg to the perfect animal. These steps are then, in effect, only metamorphoses; and similar changes are seen in the highest class of animals — Mammals — in a measure even after birth, as in the opossum and kangaroo, whose young are brought forth in so undeveloped a condition that they undergo a second gestation (or state of being borne) in a pouch of the mother, where they remain, each with the mouth fixed to a teat, until fully developed. Most mammals are for some time after birth dependent for food upon the mother's milk.

The so-called *nurse* forms or *nurses* of the distomum and the medusa are barren, incapable of producing young, hence are only protectors of the young in its development; thus force is added to the conclusion, otherwise reached, that an unchanging principle governs in life production, namely, growth from the egg germ in accordance with and conformance to distinct types, and in a method peculiar to each animal.

Fig. 3. — Kangaroo.

The changes above-mentioned are some of the most wonderful in Nature, and if upward development from the lowest forms to the highest is anywhere indicated, it must be in such cases; but we find an unvarying round — a passage through various stages to the perfect state for that animal, which again produces the egg for another similar development — a perfect answer to the surmise that the river of life can rise higher than its source.

These facts have an important bearing upon classification, for the greater the changes occurring before birth, as compared with those made afterward, the greater is the relative perfection of the animal.

The law of compensation is everywhere apparent in Nature, and nowhere more than in the adaption of animals to their surroundings and requirements.

The external organs of animals, when not needed, become rudimentary or entirely disappear, as in the case of the blind-fish of Mammoth Cave, Ky. — the condition generally of cave insects — for eyes are useless when there is no light to enter them.

Equal provision has been made for the increase or the second growth of organs when necessity demands, as in case of the second growth of the leg and tail of salamanders (newts) when they have been accidentally lost, and in the enlargement of the pectoral fins of the flying-fish as a means of escape from enemies, or of the climbing fish, *Anabas*, to enable it to ascend trees in search of its favorite food.

Likewise the color of the skin, hair, etc., bears close resemblance to the hue of surrounding objects, as the grasshopper to the general appearance of its native fields, and the tiger to the lights and shades of the jungle grass.

But the changes thus occurring, whether on account of surroundings, necessities, habits, or sexual relations, are always and wholly external, as of fingers, toes, tentacles, skin, hair, etc., at most such as affect outward form, never by any possibility extending beyond the *genus;* hence we say that *natural selection*, or, as it is sometimes termed, "the survival of the fittest," accounts only for the *preservation*, or the *outward change*, and not for the *origin* of the forms of life; and further, that there is no more adequate reason for the doctrine which obtains in some quarters that the highest of the great types and classes were evolved from or grew out of the lowest type or class, as a mammal from a jelly-fish or from a bird, than there is that life is self-creative. We must either take the position that life is self-evolved, or that it was created by intelligent force. It is as easy to conceive the intelligent creation of *all* as of *one* of the general types and classes; and it is also much more consistent.

The great types and classes are distinctly indicated by the method of development of the germ in the egg, the *type* being always earliest manifested, as seen in the accompanying diagrams; Fig. 4 showing the side divisions which indicate the rings of an articulate, Fig. 6 representing an embryo insect, the Podurella, with its back upon the yolk — a position characteristic of all articulates in embryo; and Figs. 5, *f*, and 7, *b*, giving length and end views of the dorsal furrow which marks the position of the future backbone, and determines that the animal will have a double cavity, hence is a vertebrate. The distinctive characters are likewise early seen in mollusks and radiates. The later formation of intestines, limbs, and organs of respiration determines the *class*. Thus, in case of the white-fish, the growth of whose embryo can be easily watched on account of the transparency of the egg, the segmentation or division of the yolk (which is its first change) appears much as seen in No. 2 of Fig. 21; but soon the germ vesicle has risen to the top, and about the fourteenth day the outlines of the embryo appear with the belly to the yolk in the egg, as in Fig. 8, a position assumed by all vertebrates. While the fact that it is a *vertebrate* is thus plainly indicated, yet until about the fortieth day it would as readily be taken for an embryo frog as an embryo fish. About this time its head and tail begin to separate from the yolk, and now its *class* can be determined. It is evidently a fish, yet not until long after its embryonic state is passed — which takes place about the sixtieth day (see Fig. 9) — can its genus and its species, white-fish, be known.

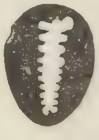


FIG. 4.

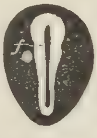


FIG. 5.

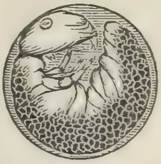


FIG. 6. — Embryo Podurella.

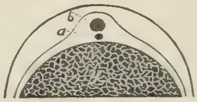


FIG. 7.

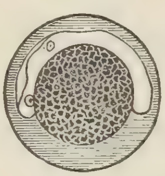


FIG. 8.

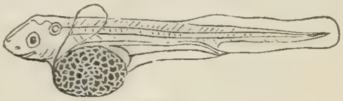


FIG. 9.

How well, then, embryology establishes the correctness of our position, that types, classes, orders, etc., are natural divisions, and rightly assigned their proper place in the preceding classification; and how well it disposes of *natural selection* as affecting types, classes, and orders, by showing that these are all settled in the embryo before outside circumstances have impressive force upon the animal, and that the *genus* is the earliest stage subject to such influence; in other words, that *internal* construction is not thus affected, hence *evolution* as such is impossible.

FIG. 10.

In the matured animal there is another decisive element of distinction of *types;* viz., *the construction of the nervous system.*

The nervous system of the Vertebrata consists of the brain and the spinal cord. (See Fig. 1, page 253, Vol. II.) The latter, enclosed within the back-bone, sends out its nerve branches (one pair from each vertebra), which, by numerous subdivisions, reach every part of the system.

The nervous system of the Articulata consists of a series of swellings of nerve tissue called ganglions, corresponding in number to the rings and subdivisions of the body, connected by threads above and below the æsophagus or gullet, and extending in a line beneath the alimentary (or digestive and excretory) canal. (See Fig. 10.)

In the Mollusca, the nerve system is a single series of ganglions and nerve threads, arranged in a circle around the œsophagus and sending out filaments to different organs, as in snails, etc. (See Fig. 11.)

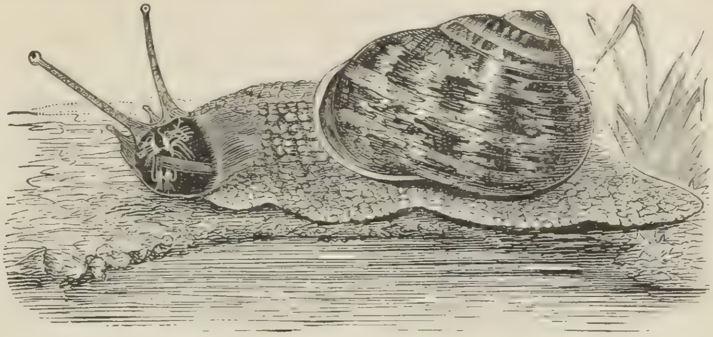


Fig. 11.

In the Radiata, the nervous system is a single ring in star-like form, arranged in a horizontal position around the mouth, and giving out threads to the circumference. (See white lines in Fig. 12, which is a horizontal section of the sea-urchin.)

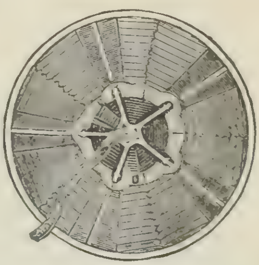


Fig. 12.

It is by this nerve system that the senses of sight, hearing, etc., are controlled; and the invertebrates possess some of these senses, though in a less degree than vertebrates.

Thus, snails are enabled to detect light by means of eyes situated on the tips of long tentacles, or at their base; spiders have eight eyes on the front part of their backs; and some star-fishes have eye spots at the ends of their rays; crabs have organs of hearing at the base of the large antennæ or feelers; while grasshoppers have membranes for hearing on the first joint of the abdomen.

In all animals there is a certain faculty which marks a degree of intelligence and distinguishes that individual from every other; it is called *instinct* when causing the animal to act in a stereotyped way, invariably the same, for its own protection or to obtain food, as in case of the bee and the majority of animals lower than man; *intellect*, when exercising judgment upon matters outside of itself or its own needs, as a dog in rescuing a child from drowning, or guarding property accidentally left by his master; and *reason* or *intuition*, when manifesting knowledge of abstract truth, or of principles separated from sense perception, as the relation of cause and effect — a power existing in man alone.

The degree of intelligence manifested, as well as complication of structure, marks the relative positions of types, and, among vertebrates, places mammals at the head, with birds, reptiles, and fishes in the order named.

We shall in a measure describe these classes as named, making reference to a few individuals only, from lack of space.

Mammals, or Mammalia, is a term derived from the Latin *mamma* (breast or pap), and is applied to all vertebrates which, having warm blood, bring forth their young alive and nourish them with milk from the breast, or pap, or teat, until they are able to subsist otherwise.

This class always has the skull united to the spinal vertebræ by two articulating or jointing surfaces, and has hair in some form on some part of the skin. The number of cervical or neck vertebræ is, with two or three exceptions, seven; and the bulky whale and long-necked giraffe in this respect agree. The limbs, excepting the whale family, are four in number; the teeth are divided into incisors (cutting teeth), canines (tearing, or dog teeth), premolars and molars (grinding teeth); the organs of respiration and vitality are separated from those of assimilation and reproduction by the diaphragm, a large muscle placed across the body cavity; the heart has two auricles and two ventricles, by means of which the separation of venous and arterial blood is complete, and only thoroughly oxidized blood, or blood warmed and purified by the chemical action of the oxygen of the air upon the venous blood in the lungs, is sent to supply the waste of the system. The blood of mammals differs from that of all other vertebrates in having the red disks or corpuscles without a nucleus or central particle, and in having the disks circular and flattened, except in the camel family, in which they are elliptical or oval. The digestive apparatus is generally as described in Medicine, pages 271–273, Vol. II., except that some herbivorous animals have four stomachs, as the ox and sheep.

Few authors agree in their divisions of this class into orders; some making but three orders, others as many as fifteen mostly based upon some comparatively trivial peculiarity. Thus, some make a distinct order of mammals whose four feet have hoofs, calling them *Ungulata*, using this terminal form as a basis for an order; others, with more occasion, make those mammals which chew the cud, as the ox, sheep, and deer, a sub-order of the Herbivora, and call them *Ruminants*.

These minor differences, variously used, tend to confuse and mislead the general reader, while the orders given in the table are simple, definite, comprehensive, and plainly include all mammals. Of the twenty-one hundred described species of living mammals, three hundred and ten are found in North America.

The CARNIVORA include the lion, tiger, bear, wolf, cat, and those mammals generally which have sharp teeth and are fitted to eat flesh.

The HERBIVORA comprise all mammals adapted to the eating of grasses and vegetable food generally, as the horse, ox, camel, elephant, sheep, and deer.

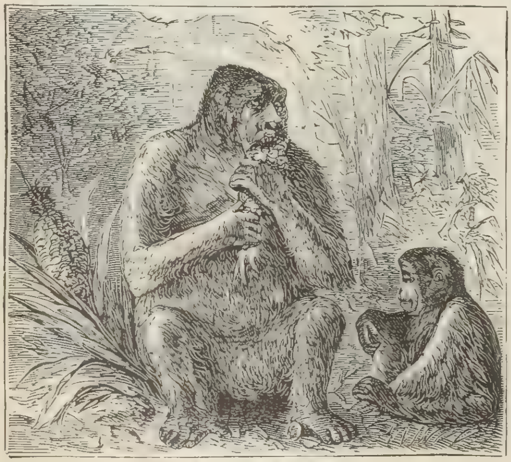


FIG. 13. – Gorilla and Young.

The CETACEA are mammals of the whale kind, as the porpoise and dolphin.

The *reason* (power of distinguishing first principles), in a body pre-eminent in its perfection and beauty, puts MAN at the head of, and beyond comparison with, the other mammals, except in a purely physical way; yet certain naturalists would find an ancestor in the *genus* monkey, because some species have legs with calves and thighs, and lack a tail. An excellent description of the human system will be found in Medicine, pages 253 to 289.

Of the monkey tribes, the *ape* is the foremost, and the *gorilla* is its highest representative. It is found on a range of mountains in Guinea, in the tropical part of Western Africa; it goes about in bands, led by a single adult male, and builds its nest in trees. It can stand partly erect, but usually uses its hands in walking. It has not a true foot, for the great toe is opposed to the small toes as the thumb is to the fingers. A full-grown gorilla has a body twice as heavy as an average European woman, while its brain is not quite half the size of an average child of four years of age, its greatest skull capacity being about thirty-four cubic inches, and the smallest human skull measuring seventy cubic inches.

The *Chimpanzee*, which inhabits the west coast of Africa from Sierra Leone to Congo, is in many respects like the gorilla, but has fourteen pairs of ribs. It has a greater likeness to man in the form of the skull and teeth, and in the proportion of the arms, but is less like him in other respects.

The *Orang-Outang*, which is an inhabitant of Sumatra and Borneo, has a form more like man with respect to the number of ribs, and the formation of the lobes of the brain, but less otherwise.

All the catarrhine or thin-nosed apes live in the Eastern Hemisphere; but the forests of all tropical countries swarm with varieties of the lower grades of monkeys, which present no features of special interest.

Of the other *Carnivora*, perhaps the *Ursidæ* or true bears are most nearly allied to the ape. They are sometimes called *plantigrades*, as is man, because they walk on the soles of their feet instead of on their toes like most of the true carnivora, the tiger, lion, etc. Bears are not confined in range, but inhabit nearly every land and every clime on the globe, and seem equally fitted for the torrid and the frigid zones. They are peculiar from the fact that they can exist on an entirely vegetable or entirely animal diet. On account of the size and shape of their feet, they can easily assume an erect position; and this they do when engaging in contests with their enemies. They are very powerful, and some species are more dangerous, when attacked, than any other of the most ferocious animals.

Bears of cold climates frequently hibernate or pass the winter in a torpid state in their dens, often buried in the snow; but it is said of the polar bears, that the female only does this, the male exercising all his faculties in winter as in summer.

The North American species are the *Ursus arctos*, including the varieties of brown, cinnamon, and grizzly bears, the *Ursus Americanus*, or true black bear, and the *Ursus maritimus*, or polar bear.

The grizzly bear (*Ursus horribilis*) has coarse, grizzly hair, and fore claws twice the length of the hind claws, sometimes six inches long; it is frequently eight feet in length, and is the most powerful and ferocious of the bear kind.

The black bear is much smaller, weighing from two hundred to four hundred pounds, and is not ordinarily fierce. The polar bear is snow white, lives on seals and fishes, and grows large and very fat, at times attaining a weight of fifteen hundred pounds.

FIG. 14. — The Polar Bear. (*Ursus maritimus.*)

Of the *Herbivora*, the elephant is the largest, the most sagacious, and generally the most remarkable animal. It has no canine teeth, but has a few large molars, with numerous enamelled ridges, and with the intermediate spaces filled with cement. The upper jaw contains large incisors, while the lower jaw has none. The brain cavity is small in comparison with the enormous skull, which is lightened by many large air cells among its bones. Growing from the front edge of the nasal bones is a long, thick, fleshy trunk or proboscis, which ends in a finger-like point exceedingly sensitive on account of the great number of nerves terminating there; and immediately beneath the point are the nostrils by means of which the animal breathes, eats, and drinks. In drinking, the elephant fills the trunk, puts its extremity into his throat, and injects the water into the stomach. Without this wonderful, useful appendage, the animal would not be able to supply itself with food; but with it, some of the most difficult tasks, requiring intelligence and skill, are performed at the command of its master. The female has udders between the fore legs from which the young one obtains sustenance.

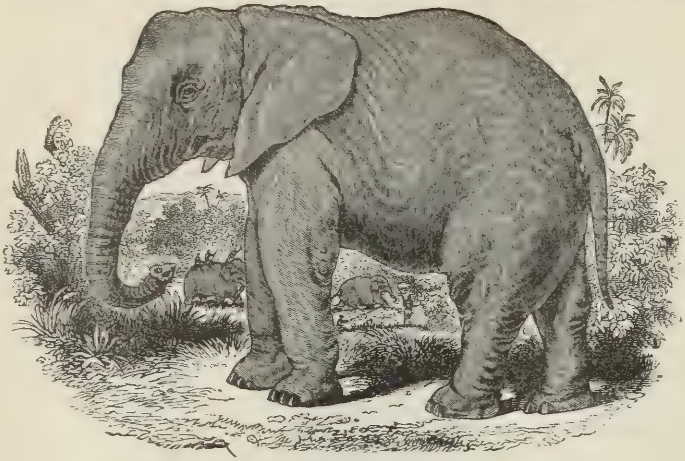


Fig. 15. — The African Elephant.

Elephants walk on their toes, which are five in number, and covered with broad, shallow hoofs. The foot is supported by broad, thick pads; the legs are almost entirely free from the body; the skin is naked. The Asiatic species has a concave forehead and small ears, while the African has a convex forehead, large ears, and but four hoofs on the fore feet, and three on the hind feet. Elephants are not naturally fierce like the carnivora; they usually range in herds and live on herbs and the leaves of trees, having a loathing for animal food. Some members of the species attain a height of fifteen feet.

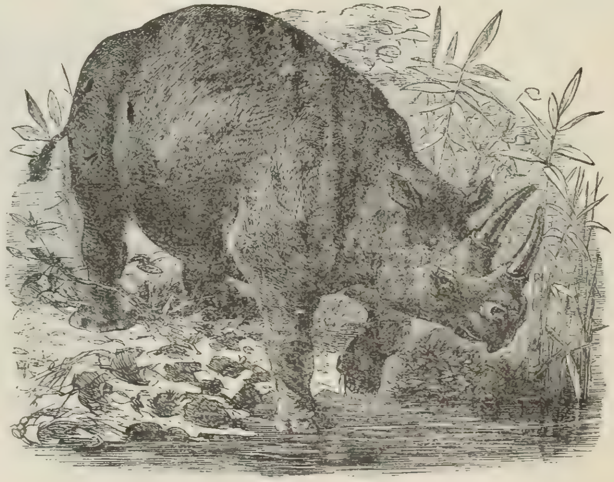


Fig. 16. — Sloan's Rhinoceros. (*Rhinoceros Keitloa.*)

The Rhinoceros ranks, among land mammals, next to the elephant in point of power and singularity of form. It lives near marshes and in jungles in Asia and Africa, is from five to seven feet high, from ten to twelve feet long, and frequently weighs six thousand pounds. Its skin is naked, lies in folds, and is so tough as to turn aside a musket ball. It has three-toed feet, with hoofs of unequal size, and incisor teeth in both jaws. From the top of its thick muzzle grows a solid horn, which is usually one or two feet long, but sometimes has a length of four feet, and is a formidable weapon of offence or defence. In some species a second horn grows from the frontal bone. It seems to relish thorny shrubs which other animals could not eat without injury. Zoölogically, the rhinoceros is considered nearer the horse than any other animal, though they outwardly appear widely separated. It likes to immerse itself in the water and mud of rivers, and sometimes wallows until nearly its whole body is covered with mud; it thus protects its tender parts from the bites of insects. The White Rhinoceros (*Rhinoceros Simus*)—the largest of the four African species—is the least irritable of all, and, even when wounded, seldom attacks its assailant, as the other species almost invariably do. It is not accustomed to range in flocks, and seems to prefer solitude. It can eat without harm herbs which are poisonous to the other species.

Of the *Cetacea*, the whale is the best representative. It has a large, broad brain, with deep, complicated depressions connected at the back with the spinal cord. It breathes air by means of true lungs as do the land mammals, and if it were forced to remain too long below the surface of the water, it would drown as would any air-breathing animal, but, on account of being supplied with a reservoir for holding a large quantity of oxygenated or arterial blood which the system uses as needed, it can sustain life under water during a much longer period than any other animal which breathes entirely through lungs. The lower jaw is straight, with narrow joints uniting it to the upper jaw. The teeth are conical, with a single root, and the eyes are situated near the back of the head. The fore limbs form a pair of paddles, supported just behind and under the head by flattened bones, the joints or fingers of which are often separated by cartilage or gristle. The small bones suspended in the flesh represent the hind limbs. Velocity is acquired by the up and down motion of the tail, which lies flat on the water, and direction is given by the fore limbs. The external nostrils are on the top of the head and form the "blow holes," certain folds of the skin preventing water from entering the air passages. The vapor blown from the holes consists of the mucus of the nostrils and the vapor of the breath. Whales feed their young during a whole year with milk from breasts situated near the navel.

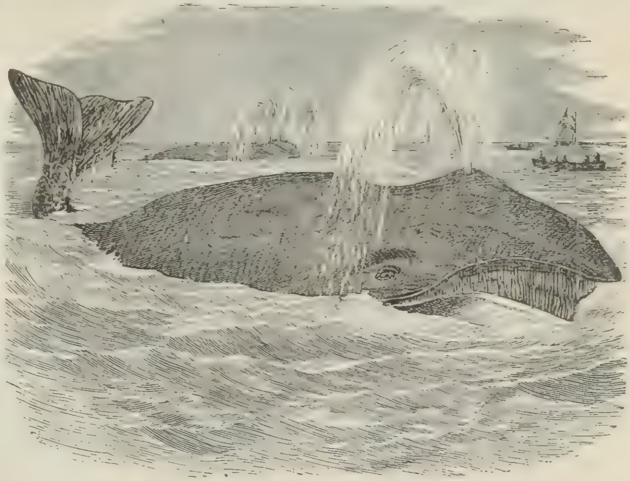


FIG. 17 — Greenland Whale. (*Balæna mysticetus.*)

The *Balænoptera boops*, or fin-back whale, is the largest of all existing animals, individuals having been found one hundred and twenty-five feet long. It sends a single column of vapor about ten feet high, while the right and hump-back whales send two streams which fall behind the head.

The *Cachelot*, or sperm whale, has the nasal, frontal, and maxillary bones filled with a fatty matter called *spermaceti*, used in the manufacture of cosmetics and ointments. Some whales yield six thousand pounds of this substance.

In the *Balæna mysticetus*, or Greenland whale, the embryo teeth are absorbed and replaced by plates of bone, several hundred on each side of the mouth, the edges of which form a strainer through which water can be expelled, while the small shell and jelly fishes on which the animal feeds are retained. This whale furnishes the most oil, which is taken from the fat enveloping the body.

AVES, or Birds, rank next lower than mammals, for, while the heart and circulation are alike, and the temperature of the blood (whose red corpuscles have a nucleus) is higher because more thoroughly oxygenated by means of air sacks distributed through the body, their general construction is less complicated, they do not bring forth their offspring, but lay eggs from which the young are hatched, hence are called *oviparous* (egg-bearing), and they are inferior in intellect.

They are distinguished from all other animals by an external growth or modification of the skin in the form called feathers, which are rendered water-proof by oil furnished from glands over the tail bone. The fore limbs, being covered with feathers, form wings which aid in running and usually serve for flight. There are never more than three fingers to the wings. The skull unites with the spine by a single joint; the lower jaw consists of several pieces united to the skull, and both jaws are toothless and encased in a horny beak. The articulation or jointing of the vertebræ is saddle-shaped, making them strong and free, especially adapted to upward motion. The breathing apparatus consists of an air tube with an upper and lower larynx, and two lungs connected with the air sacks above mentioned. Song primarily results from the vibration of air in the lower larynx. The lungs are fastened into the cavity of the thorax, but have not a diaphragm between them and the intestines.

The stomach comprises a *crop* (enlargement of the gullet to hold food until wanted), a *membranous stomach* which furnishes juices to moisten food, and a *gizzard* in which the food is digested.

The urinary and egg ducts connect with, and their products are discharged from, the excretory canal. All birds moult (change their feathers) once, some twice, and others three times each year. There are between seven thousand and eight thousand species of birds, and about seven hundred in North America.

Naturalists have almost as varied a classification of birds as of mammals; some, with Huxley, make three orders; viz., *Carinatæ* (or birds having the sternum raised in a ridge or keel), *Ratitæ* (or those having the sternum flat or raft-like), and *Saururæ* (or those having a long tail like a lizard) now extinct; but the divisions here given are in accordance with the system previously outlined.

The *Incessores*, or perching birds, have three toes extending forward, and one backward, enabling them to sit and sleep on tree branches. To this order belong the *Falconidæ* (eagles and falcons), the *Hirundinidæ* (swallows and martins), the *Corvidæ* (crows, jays, and magpies), the *Vulturidæ* (vultures, condors, etc.), the *Turdidæ* (thrushes, mocking-birds, robins, etc.), the sub-order *Rasores* (scratching birds), as the *Columbidæ* (pigeons and doves), the *Tetraonidæ* (grouse), and the *Gallinæ* (common fowl).

The *Scansores*, or climbing birds, have two toes on the front, and two on the back part of the foot. To this order belong the *Cuculidæ* (cuckoos), the *Picidæ* (woodpeckers), the *Psittacidæ* (love-birds, macaws, and parrots), etc.

The *Grallatores*, or wading birds, have long legs, destitute of feathers, and with toes straight. They include the *Struthio* (ostrich), the *Ardidæ* (herons), the *Rallidæ* (rails), the *Gruidæ* (cranes), the *Ciconinæ* (storks), the *Scolopacidæ* (snipes), etc.

The *Natatores*, or swimming birds, have webbed feet, with short legs placed far back. They include the *Alcidæ* (auks), the *Anatinæ* (ducks), the *Laridæ* (gulls and terns), the *Procellaridæ* (petrels), the *Anserinæ* (geese), the *Cygnidæ* (swans), etc.

The OSTRICH (*Struthio camelus*) of the African and Arabian deserts is the largest of living birds. It is between seven and eight feet high, can outrun the swiftest horse, and is so strong that sometimes it carries two men on its back. It has two straight toes of unequal size on each foot. The feathers of its wings and tail are so valuable that many farms in Cape Colony are devoted exclusively to ostrich culture. The female lays about thirty eggs, weighing about three pounds each, in a nest in the sand.

It ranges in flocks, and lives chiefly on vegetable matter; it can devour glass or stones with impunity.

The GOLDEN EAGLE (*Aquila chrysaëtos*), next to the vulture, is the most powerful of flying birds. It has its legs feathered to the toes. It builds its nest upon some rocky cliff, far above the limits at which most animals stop in their range upward.

It is seldom found in the Eastern States, but more frequently among the mountains of the Western Coast, and it lives on small animals, as the hare, rabbit, raccoon, etc.

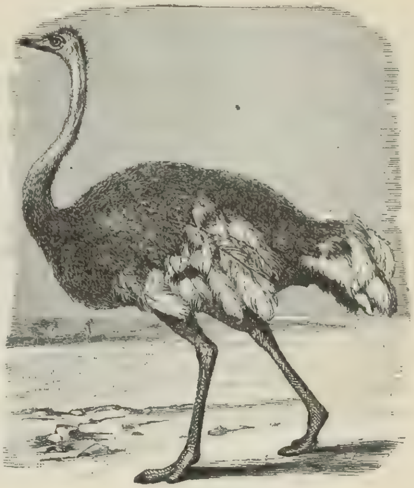


FIG. 18. — Ostrich. (*Struthio camelus.*)

REPTILIA, or Reptiles, have the following essential characteristics: The venous and arterial blood is mixed in the ventricle of the heart, or just outside the heart when it has two ventricles, hence the blood is not thoroughly oxygenated, moves sluggishly, and is cold in comparison with that of birds or mammals. The red corpuscles of the blood have a nucleus. The heart has usually but two auricles and one ventricle, but has two ventricles in the crocodile. The body is covered with plates or scales. The lungs are not separated from the abdomen by a diaphragm. There are no true lymphatic glands. The teeth are simple and conical when they exist at all. Reptiles are oviparous, and their eggs are left in the sand to be hatched by the heat of the sun. Reptiles have four short legs or none. A few snakes, as vipers, are viviparous (bring forth their young). About three thousand living species of reptiles are known, of which three hundred and fifty-eight are in North America.

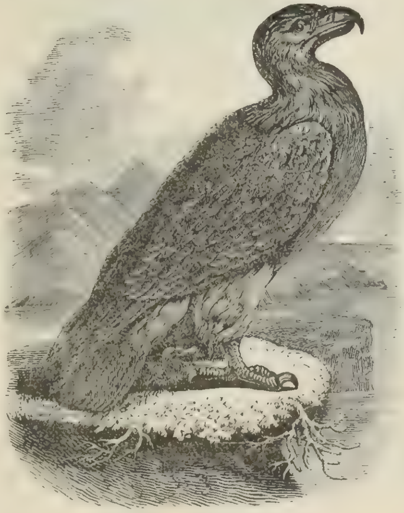


FIG. 19. — Golden Eagle.

The *Crocodile* is a true reptile of the highest order. The dorsal vertebræ are concave in front and convex behind, or the reverse. The bones of the skull are firmly united to those of the face, and the teeth are set in a single row into holes in the jaws instead of into a pit in the jaw, as in the alligator. The hind feet are webbed nearly to the toes, and a ridge of scales extends down the outer border of the hind legs, in the true crocodile and the gavial (*Gavialis Gangeticus*), a native of the Ganges in India, but this is not the case with the alligators of the Southern States of America.

The upper and lower eyelids are immovable, but the transverse or side lid, which is transparent, can be drawn over the eyeball, thus protecting the eye and at the same time permitting the animal to see things while under water. Its nostrils and throat are supplied with valves which can be closed at will to keep out the water while its prey, held under it, drowns. The length of the crocodile is usually from fifteen to eighteen feet; but it has been found thirty feet long. The alligator is from ten to fourteen feet in length when full grown.

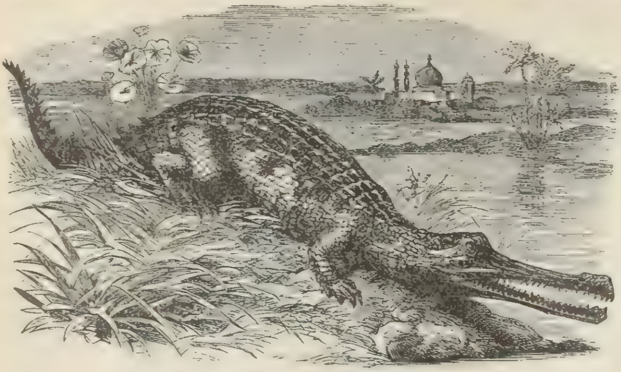


Fig. 20. — Crocodile. (*Garialis Gangeticus.*)

Batrachia, or Amphibia, are animals which, during some portion of their existence, have both gills and lungs and breathe both air and water. In most cases the fringes called gills remain only during the early life of the animal and while it is developing from the egg, left in the water to hatch, to that stage in which it is really a land animal, breathing air through true lungs.

Batrachians have true limbs and a naked skin. The common frog (*Rana halecina*) is a good example of this class. The eggs are deposited in large glairy masses in pools of water and attached to water plants for protection. Its position on leaving the egg renders the means of breathing water necessary until able to support itself on land (its normal sphere); hence it is temporarily supplied with gills. Until it reaches the tadpole state its growth is similar to that of the whitefish previously mentioned; but the yolk is entirely absorbed before it leaves the egg. When fully developed, the gills have entirely disappeared, and it breathes air only by means of lungs — two large sacks with elastic walls and numerous blood-vessels connecting with the pulmonary artery. The heart is conical in shape and contains two auricles and one

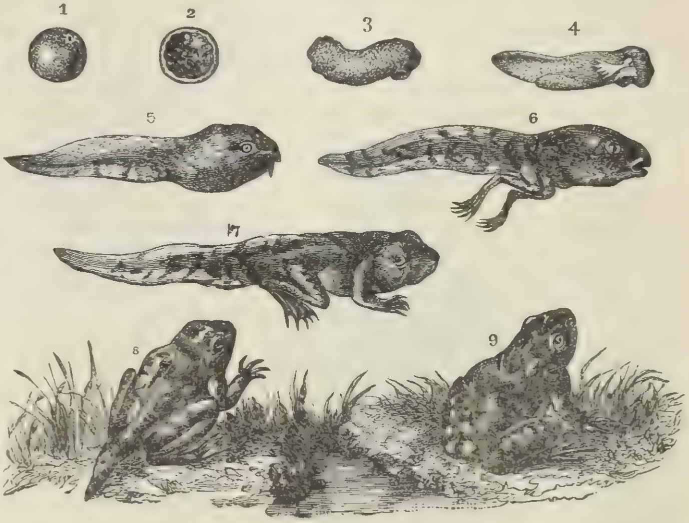


Fig. 21. — Development of the Tadpole.

1. Egg of frog. 2. The egg fecundated and surrounded by visicule. 3. First state of the tadpole. 4. Appearance of the breathing-gills. 5. Their development. 6. Formation of the hind feet. 7. Formation of the fore feet and decay of the gills. 8. Development of the lungs and reduction of the tail. 9. The perfect frog.

ventricle; hence the venous and arterial blood is mixed before leaving the heart, and full oxidation does not take place. The frog is therefore a cold-blooded animal, as are all Batrachians. Fig. 21 represents its stages of development. There are about seven hundred living species of Batrachians, of which one hundred and one are found in North America.

FISHES are the lowest of the vertebrates, breathing, in the matured state, water by means of gills, and having only a single circulation of the blood, and that constantly in one direction through the single auricle and ventricle of the heart to the gills, whence, after oxygenation, it is distributed to the various parts of the system. Hence the flow of the blood, which has large, oval, nucleated globules, is less rapid, its oxidation longer delayed, and its temperature lower than in the higher classes. The gills are delicate fringes or laminæ, supported by four long arches. The water enters the mouth, passes through the gills, and escapes at the gill openings, the needed oxygen being obtained from the air which is mingled with the water.

The air bladder, developed as an offshoot of the gullet, enables the fish to rise or sink in the water by decreasing or increasing its weight as compared with water.

Fishes generally lay eggs in quiet parts of brooks and rivers, that the young may not be disturbed, the number of eggs varying from thousands in the salmon, perch, and herring, to millions in the flounder, cod, and sturgeon.

The spine bends with perfect freedom sideways, but not vertically, and it is by the side-motions of body and tail that progress is obtained. The fins represent the limbs of the higher vertebrates. The general divisions of fishes are in a very unsettled state, but those given in the table are used as least confusing and most definite. The number of species of fishes is mere matter of conjecture; at least seven thousand are known.

INSECTS stand at the head of the *Articulata*. They have three distinct parts, the head, thorax, and abdomen, and otherwise differ from the next lower class — Crustacea — in breathing by means of internal air-tubes which open through holes or spiracles in the sides of the body. The number of segments or body divisions in the winged insects is seventeen or eighteen, usually a less number in spiders and mites, and many more, frequently two hundred, in centipedes.

To the order *Manducata* belongs the Locust (*Caloptenus spretus*, etc.). It has a thick, hard, external crust as a protection for the internal parts, and broad, solid jaws with cutting and grinding edges. Its great power of flight is due in great measure to air-sacks distributed through the body, by which it can be made of nearly the specific gravity of the air. During its migratory period every vegetable, tree, and grain leaf in its route is destroyed. The number is frequently so great as to cast a deep shade over the landscape.

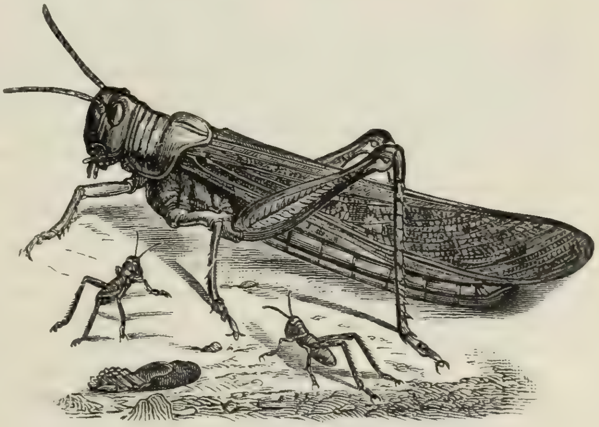


FIG. 22. — Locust and Young.

OYSTERS belong to the order *Lamellibranchiata* in the lowest class — *Acephala* — of the *Mollusca*, and yet they are the most useful of any genus in the whole department of mollusks. There are many species, but the *Ostrea edulis* or edible oyster is most valuable on account of its extensive use as food. The pearl oyster (*Meleagrina margaritifera*), found at Madagascar, Ceylon, and Panama, is the most noted on account of the enormous pearls which occur in it. A single oyster lays about two million eggs. The oyster is greatly inferior as an article of food during the summer months, and ought not to be eaten between June and September. The American oyster becomes able to swim in its larva state in seven hours after the fertilization of the egg, and soon after fastens itself to some rock. It requires three years to attain full growth, but lays eggs in one year from birth.

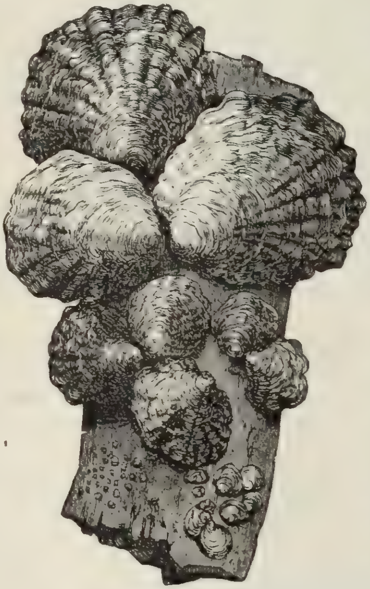


FIG. 23. — Oysters. (*Ostrea edulis.*)

The POLYP is the lowest class of the *Radiata*, yet the marine or coral polyp is the most wonderful as well as useful animal in that whole department.

The reproduction and growth of this animal is somewhat similar to that of the Hydroid Medusæ; at least, it is at first free-swimming, then attaches itself to the earth, and at once begins to put forth its tentacles much as seen in *B*, Fig. 2; but at this point it begins what the jelly-fish never does — to deposit lime, which ultimately becomes the beautifully formed and often delicately colored coral.

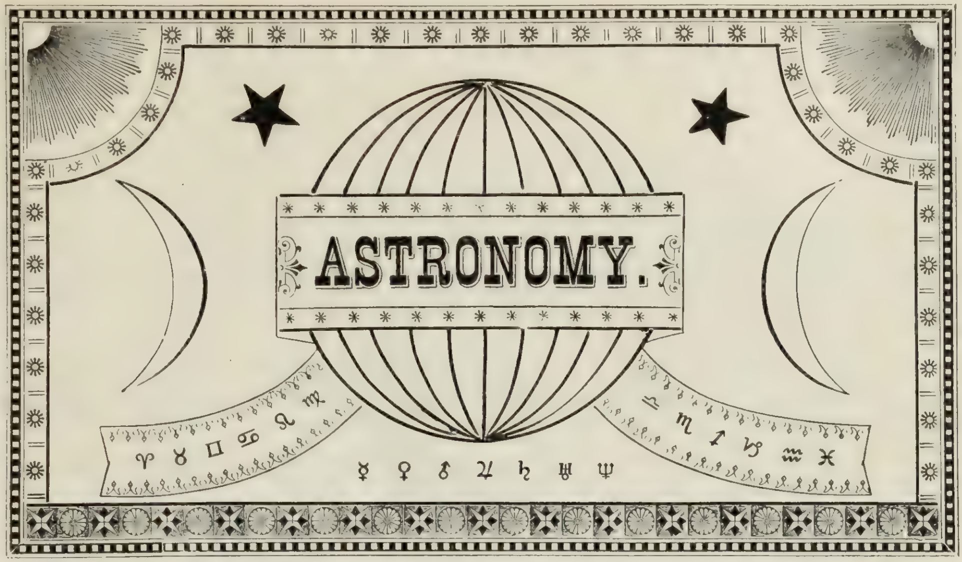
There are many species, all of which differ somewhat in their ways of propagation, and produce various kinds of coral, the most valuable being the red coral (*Corallium rubrum*) of commerce, the amount of which annually gathered is worth several hundred thousand dollars. This coral is the product of the polyps of the family *Alcyonidæ*, distinguished by the fact that their mesenteries and tentacles are always eight in number, or some multiple of four. The common species is the *Alcyonium carneum.*

The most important general results of coral production are seen in the *reefs* and *atolls*, which are chiefly built by the *Madreporaria* of the family *Zoantharidæ*. These reefs are a great protection to the shores which they line and the islands which they surround; they are called *barrier-reefs* when there is a deep channel between them and the shore, and *fringing-reefs* when in comparatively shoal water and not separated from the shore by deep channels, or when barrier-reefs are outside of them. These reefs are usually found around the shores of islands where the temperature of the water never falls below 66° Fahr.

The coral-reef polyps cannot live more than twenty fathoms beneath the surface of the water, hence it seems evident that those reefs, which are several hundreds or thousands of feet thick, must have, at least in most instances, been formed during the gradual sinking of the islands on which they are built; though Semper claims that the ocean currents and gradual elevation of the islands account for the shape and height of coral reefs; and this may be true in certain cases, as in the West Indies, but not generally.

Atolls or coral islands seldom extend more than ten feet above the water's surface, and are formed by the grinding and washing up of coral and shells by the winds and waves, gradually producing a barrier over which during storms the waves roll, thus forming a lagoon or small lake within. The Bermuda Islands are the remnants of a single atoll.

The object of this article has been accomplished in giving the true method of classifying animals, and a few brief descriptions of individuals fairly representative of their respective types and classes.



ASTRONOMY.

ASTRONOMY is that science which teaches the distribution of the heavenly bodies, their true and apparent motions in space, their magnitudes, distances, and physical conditions. Astronomy owes its existence as a science, as well as its present degree of perfection, not simply to systematic observations of the heavenly bodies, continued through centuries, but to the knowledge of the causes of observed phenomena; which knowledge is the result of wonderful general deductions, subsequently established by mathematical demonstration.

To the invention of the telescope, and its application to graduated instruments, we are in a great measure indebted for this progress, which in a physical point of view it is impossible to overestimate, for it has permitted great and permanent advances to be made in the accurate observations of the heavenly bodies. By the latest improvements in these instruments, astronomers have been enabled to note with precision the positions, motions, and characteristics of the planets, as well as to discover new phenomena beyond the reach of natural vision. Astronomy is usually divided into two parts:—

Descriptive Astronomy, which teaches the positions of the constellations with reference to various points and circles of the celestial sphere, and the phenomena occurring in the heavens.

Mathematical Astronomy, which gives the laws by which the heavenly bodies are regulated, teaches how their motions are to be calculated according to the rules of mechanics, and combines all that is known of their physical characters.

Astronomical Observation has always been one of the accompaniments of civilization, both in modern and ancient times; but the real history of written astronomy commences about one hundred and sixty years before our era. The nations which are known to have cultivated astronomy before that time are the Chinese, Indians, Chaldeans, Egyptians, and Greeks. The first made it a matter of politics, the next three of religious observance, and all four applied it to astrology. Astrologers claimed to be able to foretell the future events in the life of man by the appearance of the stars at his birth, and the art is practised even now to the detriment of the credulous.

The science which, under the name of astrology, found universal belief among all the nations of antiquity except the Greeks, and also prevailed through the whole world of the Middle Ages, is based upon the supposition that the heavenly bodies are the instruments by which the Creator regulates the course of events in this world, giving them different powers according to their different positions. Among the Greeks, astronomy had no reference either to politics, religion, or soothsaying; and there it throve with vigor, which permits us to make the astronomy of the Greeks a part of the chain which extends to modern times, where the perfection of instruments, the invention of the telescope, the astronomical clock, and the establishment of the theory of gravitation, were so many steps, each of magnitude unequalled in olden times.

We give the following historical dates, in chronological order, of the most remarkable phenomena which have appeared, and of the principal accessions to the science of astronomy in our era:—

A. D. 1543. Publication of a work on the movements of the heavenly bodies by Copernicus, setting forth his system of the universe.
1560. Occurrence of a total eclipse of the sun observed and recorded.
1567. Occurrence of an annular eclipse of the sun recorded.
1577. Apparition of a comet, the observations of which enabled Tycho Brahe to demonstrate that comets revolve in the regions beyond the moon.
1596. Publication of Kepler's work on the orbits of the planets.
1608. Invention of telescopes by Lipperhey, a spectacle-maker in Holland.
1609. Galileo made a telescope from a general description of a magnifying instrument made by Lipperhey. He used a concave object glass, Lipperhey a convex.
1610. Galileo announced the discoveries of Jupiter's satellites, of spots on the moon, of nebulæ, and of phases of Venus. Harriot observed the spots on the sun.
1639. First observed transit of Venus over the sun's disc.
1652. Apparition of a great comet.
1655. Discovery of a satellite of Saturn (Titan).
1658. Huyghens made the first pendulum clock.
1663. Gregory makes his reflecting telescope.
1664. Hooke detects the rotation of Jupiter.
1665. Time of rotation of Jupiter determined.
1666. Rotation of Mars determined.
1668. A great comet visible in southern latitudes.
1669. Newton made his first reflecting telescope.
1671. Cassini discovered a satellite of Saturn (Rhea).
1674. Invention of spring pocket watches by Huyghens.
1675. Velocity of light discovered by Roemer. Foundation of Greenwich (England) Observatory.
1680. Apparition of a great comet, which approached nearer the sun than any other comet except the one of 1843.
1684. Discovery of two satellites of Saturn (Tithys and Dione).
1687. Publication of Newton's celebrated work, "Principia."
1705. The return of the comet of 1682 in the year 1759, predicted by Sir Edmund Halley, who expressed the belief that it previously appeared in the years 1531 and 1607, and upon this he based his calculations, which were verified in March, 1759.

1727. Aberration of light discovered by Dr. James Bradley. Discovery of the nutation or vibratory motion of the earth's axis by Bradley; the announcement made in 1845.
1744. Apparition of a comet, visible in full daylight.
1759. Apparition of Halley's comet.
1767. Publication of the first nautical almanac in England.
1781. Discovery of the planet Uranus by Herschel.
1787. Discovery by Herschel of two satellites of Uranus (Oberon and Titania).
1789. Discovery by Herschel of two satellites of Saturn (Mimas and Enceladus).
1802. Discovery of the planet Pallas by Olbers.
1807. Discovery of the planet Vesta by Olbers.
1823. Apparition of a comet with two tails.
1826. Discovery of a comet by Biela.
1840. Foundation of the Observatory of Cambridge, Mass.
1842. Foundation of the National Observatory of Washington, D. C. Determination of the density of the earth.
1845. Discovery of the planet Astræa by Hencke.
1846. Biela's comet separates into two parts.
1855. Commencement of the American Nautical Almanac.
1858. Apparition of Donati's comet.
1866. Brilliant display of shooting stars on the morning of Nov. 14.

The discoveries and observations have been since that time too numerous to be mentioned in a few words, and the many details of the astronomy of the present day are to be found in periodicals devoted exclusively to astronomical subjects.

THE HEAVENLY BODIES.

The heavenly bodies are the sun, planets, satellites of the planets, comets, meteors, and fixed stars. All these (except the fixed stars) in their orderly arrangement constitute the *solar system*, so called from the Latin word *sol*, the sun.

THE SUN.—The stupendous luminary (about which body all the others revolve, and generally in elliptical orbits) to which we are indebted for many of the blessings we enjoy is the source of light and heat, and contributes materially to the development of vegetation; it also serves as a standard for the regulation of our calendar.

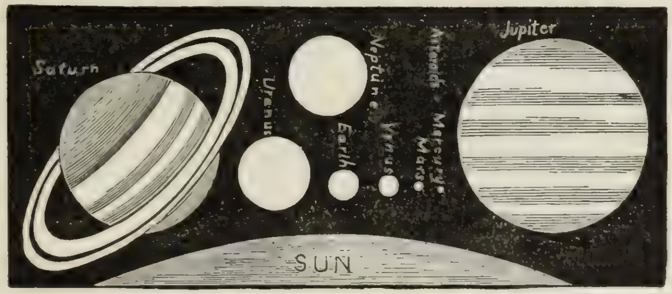


FIG. 1—Comparative magnitude of the Sun and Planets.

THE PLANETS receive their heat and light from the sun, whose rays are more or less regularly distributed according as the planet's axis is more inclined to the ecliptic. Jupiter is the largest of all the planets; Saturn, Neptune, and Uranus are the next largest; the Earth and Venus are about the same size; the diameter of Mars is about one half the diameter of the Earth; and Mercury is about one third smaller than Mars; the largest of the Asteroids is not more than two hundred and fifty miles in diameter.

All the planets united into one mass would be only about one five hundredth of the sun's volume.

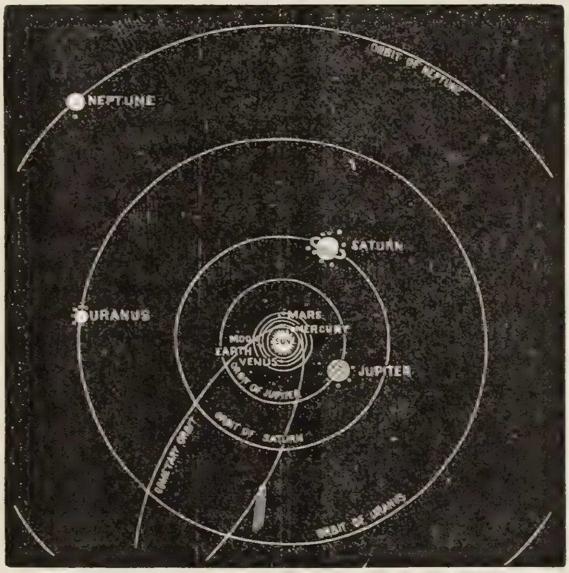


FIG. 2. — Representation of the Orbits of the Planets, and their relative distances from the Sun.

The planets are divided into *interior* and *exterior*. Those which revolve within the Earth's orbit are called INTERIOR PLANETS, and those which revolve without it are called EXTERIOR PLANETS.

Mercury and Venus are interior planets; Mars, Jupiter, Saturn, Uranus, and Neptune, together with the Asteroids, are exterior planets.

The satellites, or secondary planets, revolve about their primaries, and assist in their illumination by reflecting upon them the sun's rays, as does our moon.

Each satellite turns on its axis, and accompanies its primary in its journey around the sun.

The following table presents a comparison of the physical condition, properties, and relations of the primary planets, taken in their order from the sun: —

	Mean diameters in miles.	Relative masses.	Relative densities compared with water as 1.	Mean distances from the sun in millions of miles.	Periodic times of revolution about the sun.	Rates of hourly motion in orbit, in miles.	Periods of rotation on axis, in hours.	Inclination of axis to the ecliptic.
Mercury..........	3,000	1-16	6 1-3	35	88 days.	104,000	24	*
Venus	7,660	7-8	5 5-6	66	224 "	77,000	23 1-3	75°
Earth	7,912	1	5 2-3	91 1-2	365 1-4 "	62,500	24	23 1-2°
Mars............	4,300	3-25	4	139	1 yr., 322 "	53,000	24 1-2	28 3-4°
Jupiter	85,000	301	1 3-8	476	12 years.	28,700	10	3°
Saturn	70,000	90	1	872	29 1-2 "	21,000	10 1-2	26 3-4°
Uranus...........	33,000	16 4-5	9-10	1,754	84 "	15,000	9 1-2	*
Neptune..........	37,000	12 2-3	3-4	2,746	165 "	12,000	*	*

THE EARTH.

THE EARTH is a large globe of material substance, having its surface broken up into elevations and depressions, or mountains and valleys; but these are of very trifling extent when compared with the entire bulk of the globe. The deepest depressions of the earth's surface contain oceans and seas.

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* Not known.

It is popularly thought that the central mass of the earth, which cannot be seen, is kept by intense heat in a liquid and molten state, like the lava which overflows from volcanoes; but the ablest of our scientists of to-day give the strongest philosophical and mathematical reasons for believing that the centre of the earth has a greater density than the circumference, and that the lava of volcanoes is only the result of local disturbance or of chemical action in the substance of the earth which is just within the outer crust and between it and the solid centre. The earth is isolated in space: in whatever direction travellers or sailors go, they never find any sort of material prop in connection with its surface.

THE FORM of the earth appears to its inhabitants as an immense plain, stretching out to an indefinite extent in all directions; but we may assume from circumstances appealing to our reason and our senses that it is of a spherical form.

The following are some of the reasons which may be given for such an assumption:—

1. If we stand upon the sea-shore and watch a ship which is receding from the land, we shall find that the topmasts remain in sight after the hull has disappeared. If the surface of the sea were merely an extended plain, this would not happen; for the topmasts, being smaller in dimension than the hull, would in that case disappear first.

2. A lunar eclipse occurs when the earth is situated between the moon and the sun. Now, the shadow which the earth at such a time casts upon the moon is invariably circular in form; and a body which in every position casts a circular shadow must be a globe.

3. Navigators sail around it, proceeding in the same general direction east or west, and arrive at the same point whence they started.

The earth is not, however, a perfect globe. It is shaped more like an orange, bulging out somewhat in the direction of one great circle of its circumference. This kind of form is called a spheroid, to distinguish it from a perfect globe. The bulging-out portion of the earth is that particular zone of surface which lies midway between the two points which are called the POLES.

The central line of this bulging part is called the EQUATOR. This is everywhere at an equal distance from the poles; and the straight line which is conceived to run through the centre of the earth to connect these points together is termed the AXIS of the earth.

Axis is derived from the Latin word *axis*, an axletree.

The equatorial part of the earth bulges out until it is $\frac{1}{298}$ part farther away from the centre than the flattest part near either pole; that is to say, the breadth of the equatorial part of the earth is to the breadth between the poles as 299 is to 298. The polar diameter is 7,899.17 miles, and the equatorial diameter is 7,925.648 miles.

MOTIONS OF THE EARTH. — Two principal motions belong to our planet: one of rotation upon its axis, called its *daily* motion, producing the succession of day and night; and another of progression in space or motion round the sun, called its *annual* motion, causing the vicissitude of the seasons. Both of these motions are to be understood of the whole earth, — its interior substance, its superficial masses of land and water, the surrounding atmosphere, and the clouds in suspension over it; and both motions are in the same direction, from west to east.

The exact time occupied by the daily or diurnal motion is 23 hours, 56 minutes, and 4.09 seconds.

The annual motion of the earth occupies a period of 365 days, 5 hours, 48 minutes, 49.7 seconds.

As the mean distance of the earth from the sun is 91,500,000 miles, the diameter of the circle which it makes around the sun is twice that, or 183,000,000 miles, and its linear extent near 550,000,000 miles.

This enormous distance is traversed at the rate of 62,500 miles an hour, or 17 miles in a second. This is the mean velocity for the year. The motion of the earth around its axis and also that around the sun is imperceptible by us; resembling that we experience in floating down a stream, when the shore appears to be in movement and we are not aware of our own progression. There are four noteworthy points in the earth's orbit around the sun, those which mark the beginning of the four seasons of the year.

Two of these points are called the SOLSTICES; they mark the beginning of winter and summer. The other two points are the EQUINOXES, *vernal* and *autumnal*, marking the commencement of spring and autumn. Although at the end of December the earth is nearest the sun, yet at that time in the northern hemisphere the heat is less than at any other. The reason of this lies in the fact of short days and long nights, as well as that the sun's rays fall very obliquely on the earth, traversing a longer path through the atmosphere, each ray extending over more surface, and in consequence affording less heat to a given space. At the beginning of July, on the contrary, although the earth is at the greatest distance, the temperature of the northern hemisphere is greatest, on account of the long days and short nights, and the greater altitude of the sun at noon, on which account a greater number of rays fall on a given space.

THE SEASONS are caused by the inclination of the earth's axis to the plane of its orbit; for the amount of heat received at any place from the sun depends upon the direction of the rays. In summer the rays are less oblique than in winter, and consequently the heat is greater; and this is still further increased by the greater length of the day.

Spring, *summer*, *autumn*, and *winter*, in the northern hemisphere, are marked and limited respectively by the arrival of the sun at the vernal equinox, the northern solstice, the autumnal equinox, and the winter solstice. They are regular, — that is, the same from year to year, — because the axis always points in the same direction, or remains parallel to itself. When the sun is at either of the solstices, summer is produced in that hemisphere which is turned towards the sun, and winter in the other, the rays falling directly on the former and obliquely on the latter. When the sun is at either of the equinoxes, the earth's axis leans sidewise to it, and the rays are direct at the equator, and equally oblique on both sides of it; consequently there is *spring* in that hemisphere which the sun is about to enter, and *autumn* in that which it has left. The foregoing statements will be understood by an inspection of the accompanying illustration.

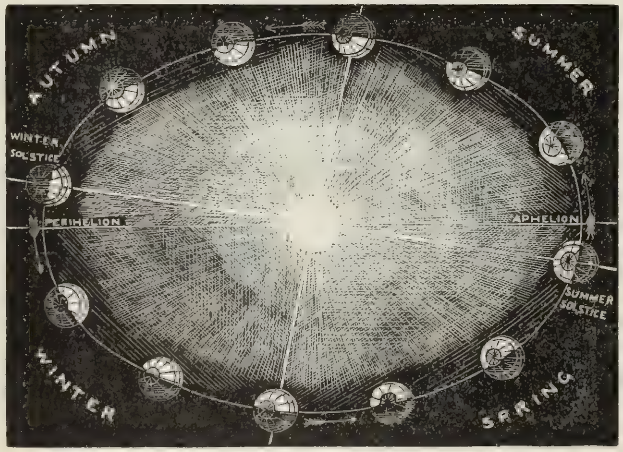

FIG. 3. — The Seasons.

THE ATMOSPHERE of the earth — the region of air and gases surrounding our globe — is interesting on account of its effect in displaying to us the heavenly bodies and diffusing the rays of light in every direction around us. Upon the atmosphere respiring beings depend for vitality. The extent of this wonderful envelope is not precisely known. To whatever height we ascend mountains, we still find that air is present. We know that there is a limit to the atmosphere; but the height is far greater than any to which we can attain, and is estimated to be of a density, at the altitude of 212 miles, sufficient to cause refraction of light.

Air is a substance which has weight, and is very elastic; hence the air near the surface of the earth, which has to bear the weight of all the air above it, is of course much more condensed than the upper air. At a very inconsiderable elevation the air becomes so rare as to interfere with the functions of existence.

ATMOSPHERIC REFRACTION. — In viewing a celestial body we have always to look through the atmosphere by which the earth is surrounded. This produces an apparent displacement of the celestial body by what is called refraction. A ray of light passing through the different layers of the atmosphere deviates from its straight course before it reaches the eye, and would cause us to judge erroneously the real position of the celestial body which we observe. The so-called blue sky is really the imperfectly transparent atmosphere.

The white light of the sun consists of seven different colors. These all pass through the earth's atmosphere together, until they strike upon the terrestrial surface; they are then thrown back again (reflected), and are absorbed by the air, except the blue, which is again sent back towards the earth, and arriving there, excites in the eye the sensation of color which we call *blue*. This is why external space seems to be blue during daylight.

It is really the air that is blue. When travellers ascend high mountains during daylight, the sky gets blacker and blacker, because there are less particles of air above the observer to send down blue rays.

TWILIGHT is faint daylight reflected down from the imperfectly transparent atmosphere, and from the vapors mingled therewith, after the sun has set.

The diffused daylight, which is so serviceable and pleasant, out of direct sunshine, whilst the sun is above the horizon, is due to the same reflecting and scattering power of the atmosphere. But for it nothing would be visible out of direct sunshine, and every shadow would involve objects placed in it in pitchy darkness.

The visible portion of the expanse of space in which we see remote bodies is called the *sky*. The circle where the sky seems to rest upon the earth all around is called the *horizon*.

In the open ocean the horizon can be seen surrounding the observer as a complete, even circle. If the observer ascends an elevation, as the mast of a ship, this circle becomes depressed, — that is, more of the earth's surface comes into view; and the portion of the earth on which the sky appears to rest consequently becomes more distant.

The depression of the horizon, caused by the observer's elevation above the earth's surface, is called the *dip* of the horizon. The horizon is thus really the circle that bounds an observer's view so far as the earth is concerned.

Horizon is derived from the Greek word ὁρίζω, to bound.

The apparent positions and dimensions of the heavenly bodies are altogether different from their real positions and dimensions. The sun and moon appear to be very near together about the time of *new moon*, although one is millions of miles beyond the other. So also they appear to be of nearly the same size in the sky, although one is more than a million times larger than the other.

The apparent positions and dimensions of these bodies are estimated by what is termed ANGULAR MEASUREMENT.*

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* For explanations of angles, degrees, etc., see Geometry.

The degree in which two straight lines diverge is estimated by observing what proportional part of a circular area is contained between them. Area means merely superficial extent. Each right angle is, for convenience' sake, considered to be subdivided into ninety smaller and equal parts. Each ninetieth part of a right angle is called a *degree.*

Each degree is again subdivided into sixty equal parts called minutes; and each minute is subdivided into sixty equal parts termed seconds of angular measure. Degrees, minutes, and seconds are marked by the signs °, ′, ″, respectively.

Angular measurement is applied to determine the exact apparent dimensions and positions of bodies, by noting the nature of the angle within which separate bodies or the opposite extremities of the same body are included.

It is of the highest importance to astronomers in accurately noting apparent dimensions, positions, and changes of place of the heavenly bodies, from which their real sizes, distances, movements, and relative arrangement in space may be deduced.

The point of the sky which is equally distant from all parts of the horizon is called the *zenith.* The semicircular line which divides the celestial hemisphere equally into eastern and western halves is called the *meridian*, which is derived from *meridies*, noontide, because the sun is there at noon.

The exact position of any spot in the hemispherical sky may be fixed so as to be known with certainty at any time, by noting its distance in degrees, minutes, and seconds of angular measure from the horizon and from the meridian.

The distance of any object in angular measure from the point of the horizon vertically beneath it, is called its ALTITUDE.

Vertical signifies *overhead.* A *vertical line* is a line dropped from overhead; from *vertex*, the top.

Altitude is derived from *altitudo*, height. It is the height of a body above the horizon.

The distance of a heavenly body east or west, measured on the horizon, from the south point to the vertical circle which passes through the body, is called the AZIMUTH of the body.

The *azimuth* is reckoned in degrees of the circular horizon, and the altitude is reckoned in degrees, etc., of a great circle, passing vertically through the horizon, the object itself, and the zenith.

The altitudes and azimuths of objects in the sky are ascertained by employing an instrument so constructed that it can measure vertical and horizontal angles at once, and thence called *the altitude and azimuth instrument.*

The celestial bodies appear to an observer on the earth to occupy a surrounding spherical concavity, at the centre of which our planet is placed; and the phenomena of their rising and setting are appearances which necessarily present themselves in consequence of the rotation of the earth about its axis.

This apparent concavity is called the celestial sphere, and science traces upon it a variety of circles analogous to those conceived to be traced on the terrestrial globe.

THE MOON. ☽ (Crescent.)

This is the only satellite of our earth, and is very valuable to mankind. It serves as a guide to the mariner in the trackless path of the ocean, and its influence, combined with the sun, produces the tides. It is the nearest to the earth of all the celestial bodies.

This is manifest, because it is seen to pass in front of many of them, hiding them for a time; and those which lie in the portions of the sky to which the moon never travels are all fixed stars, which are known to be as remote as the rest of the shining host.

The moon is rendered visible to the dwellers on the earth by the sunshine that falls upon it.

That the moon is a dark body, and without inherent light of his own, is made evident by the fact that when the earth comes between it and the sun, which occasionally happens, its shining face becomes dark, and disappears from the sky. Also, when the moon comes between the earth and the sun, which frequently happens, the moon disappears, because then the side that is lighted by sunshine is turned away from the earth.

The moon, like the earth, is a globe-like body.

The full moon looks like a disc resting upon the face of the sky; but that the apparent disc (which is defined as a flat surface enclosed within a circle, and is derived from the Latin word *discus*, a quoit) is actually a globe becomes evident when the moon is watched night after night. It will be seen that it then presents changing appearances which can only be accounted for on the supposition that it has a globular form.

The varying appearances or phases of the moon depend upon different proportions of the illuminated half being within sight from the earth at different times. As the moon is a globular body and entirely dependent upon the sun for its light, only one half of the surface can be in sunlight at once, the other half being of necessity in the shadow of the ball.

But the lighted half is not always entirely in sight from the earth. When the dark side is turned towards us it is called *new moon.*

Soon after the time of new moon only a little crescent border of it is visible, when it is said to be in the first quarter.

This crescent increases night after night until half the illuminated face presents itself as a semicircle, and then it is called *half-moon.*

Then the flat side of the semicircle bulges out more and more until about three quarters of it is visible to us, and it is then said to be *gibbous;* and ends at last in the complete circular disc of the *full moon.*

Gibbous means hunchbacked, or bunched out, and is taken from *gibbus*, hunchbacked.

The same side of the moon is always turned towards the earth. This is ascertained by there being spots of shadow upon its face, which are always visible when the moon itself can be seen. The side which contains these spots is always directed towards the earth; hence we are never able to catch a glimpse of the other half. The sunshine, therefore, apparently advances over the globe of the moon to produce the varying phases that are observed; but in reality the moon is constantly changing its position relatively to the earth and sun, hence the *change of phase. Phase* is derived from the Greek φάσις, an appearance.

The moon, like the earth, spins upon itself in the sunshine, and so has every portion of its sphere alternately passing through daylight and nocturnal darkness.

But the moon turns upon itself once in a month, instead of once in a day. The moon's day and night are therefore together a month long.

The moon keeps the same face always towards us, by shifting its position round the earth, although it is revolving continuously and turning different parts of its surface successively to the sun. It turns once upon its axis and moves once round the earth in the same interval of time. This must be the case, since the same half of the lunar surface is always presented to us. It completes its journey round the earth in 27 days, 7 hours, 43 minutes, and 11½ seconds. This fact is known from the moon's regular return to the same point of the heavens after this interval, called its *sidereal period;* but 29½ days must elapse after one full moon before another appears in the sky, and this is called the *synodical month* or *lunation.* The moon has three motions: one on its own axis in about 27¼ days; the second in its orbit around the earth, in about the same length of time; and the third, as an attendant on the earth round the sun. It revolves on its axis about thirteen times in one year.

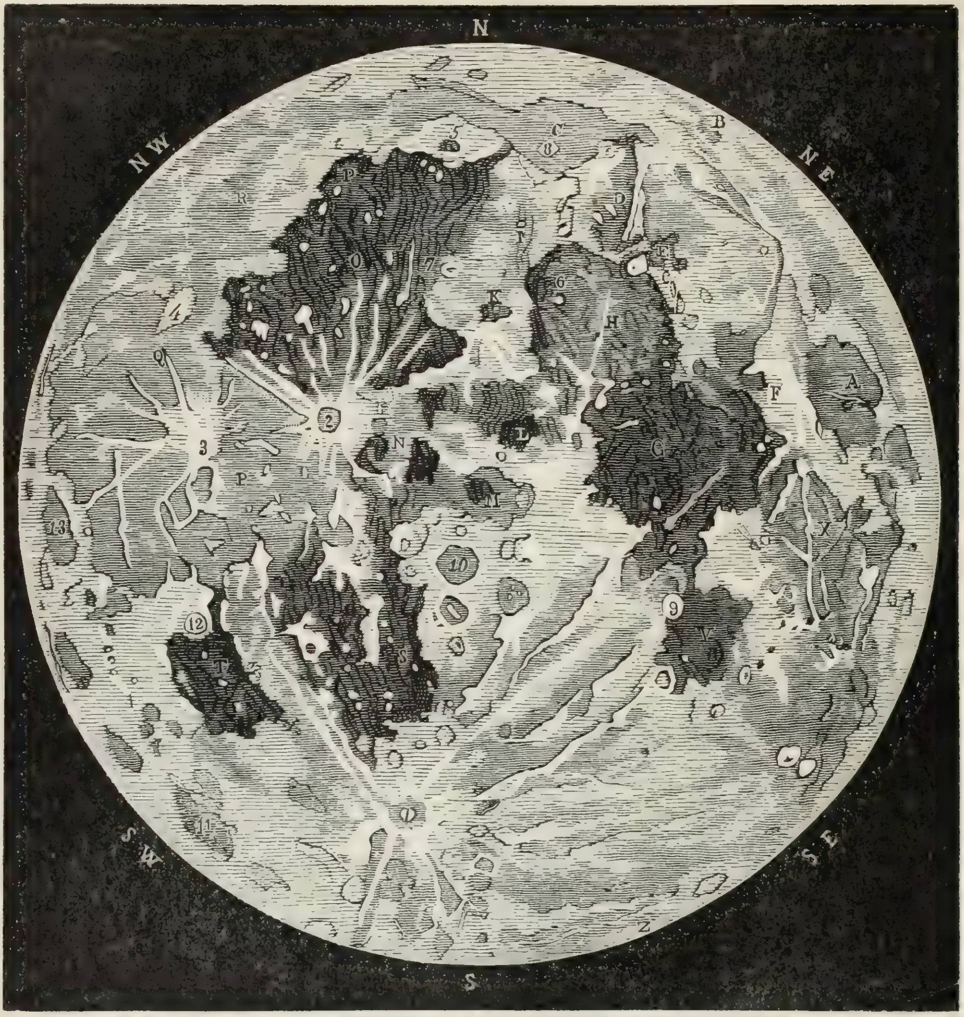

Fig. 4.—TELESCOPIC VIEW OF THE MOON.

LUNAR SEAS OR GRAY PLAINS.

A. The Sea of Crises (*Mare Crisium*).
B. Humboldt's Sea (*Mare Humboldtianum*).
C. The Sea of Cold (*Mare Frigoris*).
D. The Lake of Death (*Lacus Mortis*).
E. The Lake of Dreams (*Lacus Somnorum*).
F. The Marsh of Sleep (*Lacus Somni*).
G. The Sea of Tranquillity (*Mare Tranquillitatis*).
H. The Sea of Serenity (*Mare Serenitatis*).
I. The Marsh of Fogs (*Palus Nebularum*).
K. The Marsh of Corruption (*Palus Putredinis*).
L. The Sea of Vapors (*Mare Vaporum*).
M. Mid-Moon Bay (*Sinus Medii*).
N. The Bay of Tides (*Sinus Æstuum*).
O. The Sea of Showers (*Mare Imbrium*).
P. The Bay of Rainbows (*Sinus Iridum*).
Q. The Ocean of Tempests (*Oceanus Procellarum*).
R. The Bay of Dew (*Sinus Roris*).
S. The Sea of Clouds (*Mare Nubium*).
T. The Sea of Liquids (*Mare Humorum*).
V. The Sea of Nectar (*Mare Nectaris*).
X. The Sea of Fecundity (*Mare Fœcunditatis*).
Z. The Southern Sea (*Mare Australe*).

LUNAR RING-MOUNTAINS AND CRATERS.

1. Tycho.
2. Copernicus.
3. Kepler.
4. Aristarchus.
5. Plato.
6. Linné.
7. Archimedes.
8. Aristotle.
9. Theophilus.
10. Ptolemæus.
11. Schickard.
12. Gassendi.
13. Grimaldi.

No celestial object is better known to us, by means of the telescope, than the moon, whose distance is brought optically within less than two hundred and fifty miles of the earth. In viewing it, the observer is immediately struck with the roughness of its surface and the numerous circular formations, which appear as if surrounded by a steep and high wall.

There are also caves and immense mountain chains which surpass those of the earth, and can even be seen with the naked eye. Other portions are nearly level and of great extent. When the moon is full it has an appearance similar to the human face; examined by means of the telescope, craters, peaks, and banks of a grayish tinge are discovered. (See Telescopic View of the Moon.)

In consequence of various observations, most astronomers believe that there is neither water upon nor air about the moon, but that it is a rude desert of rugged rock, enclosed in void space and surrounded by unbroken stillness. There can be no living creatures upon the moon, at least not upon this side, at all resembling those which are so abundant on the earth, as neither plants nor animals like ours could exist where there is neither water nor air, though some few astronomers claim that there may possibly be a low form of atmosphere on the farther side, and hence life of some sort.

The distance of the moon from the earth is about 240,000 miles. Its diameter is about 2,160 miles, or about one fourth the diameter of the earth, and its surface has about the same extent as the continent of America.

The SUN is a vast sphere, slightly flattened at the poles. It is nearly 1,500,000 times the size of the earth, and is 91,500,000 miles distant.

The moon, revolving around the earth, sometimes passes quite in front of the sun, and conceals it from sight.

The sun turns upon its axis in twenty-five days, and sends off very intense light and heat, which are supposed to emanate from its outer atmosphere, which is probably an electric flame-coat of the sun separated from its dark and solid surface beneath.

The sun is a material body, for it exerts the attraction of gravitation over other bodies.

The outer envelope is in constant motion, and through its rents, patches of dark substance are to be seen, which are called solar spots; some of them are immense and all in constant change.

The material of the sun is about as heavy as coal.

THE ECLIPTIC is a great circle representing the sun's apparent path throughout the year.

It touches the Tropics of Cancer and Capricorn and is inclined to the equator at an angle of 23½°.

The two points where it cuts the equator, or equinoctial, are called the *equinoctial points.*

SIGNS OF THE ZODIAC.—The ecliptic is divided into twelve equal parts, called the signs of the zodiac; each part, therefore, contains 30°. There are six northern and six southern signs. The sun appears in the former during our spring and summer months, and in the latter during our autumn and winter months.

The days on which the sun enters the different signs are as follows:—

NORTHERN SIGNS OF THE ZODIAC.

SPRING SIGNS.	SUMMER SIGNS.
♈ *Aries*, the Ram, 21st of March.	♋ *Cancer*, the Crab, 21st of June.
♉ *Taurus*, the Bull, 20th of April.	♌ *Leo*, the Lion, 23d of July.
♊ *Gemini*, the Twins, 21st of May.	♍ *Virgo*, the Virgin, 23d of August.

SOUTHERN SIGNS OF THE ZODIAC.

AUTUMNAL SIGNS.	WINTER SIGNS.
♎ *Libra*, the Balance, 22d of September.	♑ *Capricornus*, the Goat, 21st of December.
♏ *Scorpio*, the Scorpion, 23d of October.	♒ *Aquarius*, the Waterman, 20th of January.
♐ *Sagittarius*, the Archer, 22d of November.	♓ *Pisces*, the Fishes, 19th of February.

THE ZODIACAL LIGHT, resembling the light of the Milky Way, appears at certain seasons just after sunset or immediately before sunrise, and is supposed to be a nebulous ring, or according to another conjecture, a belt of meteors surrounding the sun.

THE ZODIAC (Greek ζωδιακός, pertaining to animals) is a belt on the celestial sphere, extending about 8° on each side of the ecliptic.

ECLIPSES. — An *eclipse* of the sun is called a *solar* eclipse, and that of the moon a *lunar* eclipse.

When the moon comes between the earth and the sun its light is obstructed, and a total or partial eclipse of the sun is produced; and a total or partial eclipse of the moon takes place when the earth is either wholly or partly between the sun and moon.

The LATITUDE of a star or planet is its distance from the ecliptic, north or south; and its LONGITUDE is the distance of the point where the great circle which passes through it cuts the ecliptic, reckoned eastward on the ecliptic from the first point of Aries. Its distance north or south from the celestial equator is called its DECLINATION; and its distance from the great circle which passes through the first point of Aries, reckoned on the equator eastward, is called its RIGHT ASCENSION.

The imaginary circles and points upon the celestial globe are taken from the terrestrial in order to find the place of a star.

TIME. — The *tropical* year is 20 minutes and 20 seconds shorter than the *sidereal* year, on account of the precession or gradual falling back of the equinoxes, or points where the sun crosses the equator; hence the civil year is 5 hours, 48 minutes, 49 seconds, or about one fourth of a day more than three hundred and sixty-five days.

In order to have a more perfect calendar, and at the same time a whole number of days in each year, Julius Cæsar established the system of calling the tropical or civil year three hundred and sixty-five days for three successive years and three hundred and sixty-six days for each fourth year, called leap year; but this being about eleven minutes too much, Pope Gregory XIII., in 1582, made further changes in the Julian year as follows: —

Every year *exactly divisible* by 4, and not by 100, also every year divisible by 400, has three hundred and sixty-six days; every year *not* divisible by 4, and every one divisible by 100 and not by 400, has three hundred and sixty-five days.

The Gregorian calendar, while not perfectly correct, will have an error of less than a day in 4,000 years.

* GRAVITATION is that power which impels bodies towards each other, and regulates the motions of the heavenly bodies. It explains also the TIDES, which are two periodical motions of the waters of the ocean, produced by the attraction of the sun and the moon; they are called *ebb tides* and *flood tides*. For a little more than six hours, the sea in certain places gradually swells and then flows into harbors; this is called *flood* tide.

At the end of this time the ocean has attained its greatest height; this is called *high water*.

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* See Physics.

The waters then begin to ebb or fall, and so continue for a little more than six hours, until they arrive at their lowest level; and this is called *low water*.

Interior or **Inferior Planets** are those whose orbits are within that of the earth. There are two such planets; namely, Mercury and Venus.

MERCURY. (Sign, ☿ the snake-twined staff of Mercury.)

Its diameter does not exceed 3,000 miles, whereas the earth is about 8,000 miles in diameter.

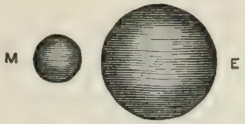

Fig. 5. — Comparative sizes of the Earth and Mercury.

It is the nearest known planet to the sun, and its mean distance from it is 35,000,000 miles. Mercury, moving at the rate of 104,000 miles per hour, performs one revolution around the sun in about eighty-eight of our days, which makes its year. It is believed to revolve on its axis once in about twenty-four hours.

The sun's heat at that planet is supposed to be seven times greater than on the earth; but it may be provided with an atmosphere so constituted as to absorb a large portion of this intense heat, so that its climate may be as temperate as any on our globe. It exhibits phases similar to those of the moon.

VENUS. (Sign, ♀ a mirror with a handle.)

This planet is situated nearest to the earth, and shines so brightly because, being nearer to the sun than the earth, it receives more of its light and reflects it to the earth.

Its diameter is about 7,660 miles (but little less than the diameter of the earth), and it makes one revolution round the sun in about thirty-two weeks, at the rate of 80,000 miles an hour; it also revolves on its axis in about twenty-three and a half hours. It shows phases like the moon, and has seasons; its atmosphere seems to be like our own.

Venus is morning star when seen in the east before sunrise, and evening star when appearing in the west at or after sunset. Like Mercury, Venus is sometimes seen to pass across the sun's disc or face like a dark spot, which passage is called the TRANSIT of the planet.

Transits of Venus afford a very exact means of ascertaining the sun's distance. A transit of Venus took place Dec. 8, 1874, and another occurred Dec. 6, 1882; the next transit will take place at the expiration of one hundred and five and a half years.

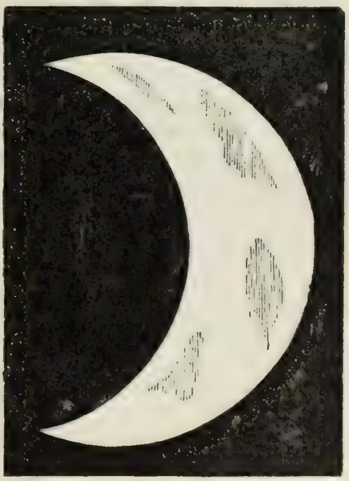

Fig. 6. — Venus, in one of its phases, showing the markings on its surface.

Exterior Planets. — Their orbits are outside of the earth's orbit; their names are Mars, the Asteroids, Jupiter, Saturn, Uranus, and Neptune.

MARS. (Sign, ♂ lance and shield.)

Mars is about 4,300 miles in diameter (a little more than half the diameter of the earth). Its general appearance is that of a dusky red color, sometimes variegated by patches of different shades of color and brilliancy. Sometimes white spots, supposed to be snow, surround the pole and diminish gradually under the influence of the solar heat when near the sun. It seems also to have continents and seas upon its surface. This planet revolves on its axis in a little more than twenty-four and a half hours, and around the sun in about twenty-two and a half months, or one year and three hundred and twenty-two days. It has two seasons, summer and winter; and it has constant day at the south pole during two hundred and ninety-seven of our days, and constant day at the north pole during three hundred and seventy-two days.

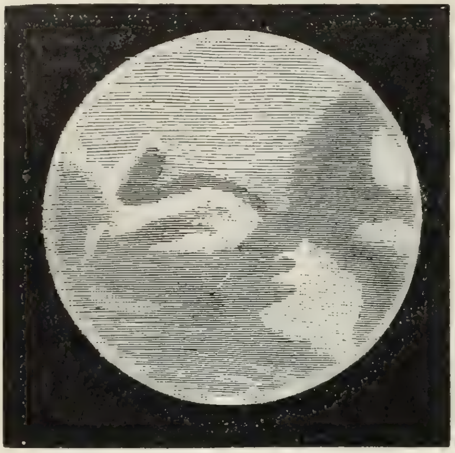

Fig. 7. — Appearance of the surface of Mars.

It is thus night at one pole while day at the other. Two small satellites of this planet were discovered in August, 1877. It appears to be enveloped in a dense atmosphere.

Asteroids. — They are a group of very small planets, which revolve about the sun in periods varying from three to five years. They are not very distant from each other, and are beyond the orbit of Mars. The number now known is two hundred and twenty. They are designated by a small circle with a number within it, in the order of their discovery, which began in this century; several are discovered every year. Vesta, Juno, Ceres, and Pallas are the principal ones. Most of them are named after the deities of mythology, and are believed to be fragments of one older planet; their distances from the sun are from 200,000,000 to 300,000,000 miles, and the largest is not over three hundred miles in diameter.

Jupiter. (Sign, ♃ an altered initial letter of the Greek word Ζευς, Jupiter.)

This largest and brightest planet of our system has a mean diameter of 85,000 miles, and revolves on its axis once in about ten hours. Its mean distance from the sun is about 476,000,000 miles, and it moves around it in a little less than twelve years. It has four satellites, belts on its face, and is enveloped by a vaporous atmosphere.

In 1878 a large red spot was discovered in its southern hemisphere, which has not disappeared yet.

Saturn. (Sign, ♄ rude representation of a scythe.)

Its mean diameter is about 70,000 miles. Its day is ten and one half hours in length, and its year is equal to twenty-nine and one half of ours. It is encircled by three broad rings, and shows belts on its surface. It has eight satellites, and a change of seasons similar to our own, but twenty-nine and one half times as long.

Uranus. (Sign, ♅ for Herschel, its discoverer.)

Its diameter is 33,247 miles; it revolves on its axis once in about nine and one half hours, and around the sun in about eighty-four years; it is about 1,754,000,000 miles from the sun, and has four satellites.

Neptune. (Sign, ♆ trident.)

It is 37,000 miles in diameter; turns upon its axis; has a year equal to one hundred and sixty-four of ours; is 2,746,000,000 of miles from the sun, and has one satellite.

COMETS. — The word is derived from the Latin *coma*. Their centre is the brightest part, called the head or nucleus; it is sometimes surrounded by a veil called the *envelope*, and their luminous train is called the *tail*.

Comets have often excited the fears of the multitude.

They differ from the planets in their appearance and irregular motions. They shine by light received from the sun, and grow brighter and their tails increase in length as they approach the sun, until they are lost in his rays. They are like thin clouds, and stars are visible through them. Some of them have enormous dimensions. The head of the great comet of 1811 was 1,125,000 miles in diameter. They move in very large orbits round the sun. Twenty comets have appeared a second time, eight of them at certain periods, as Encke's and Halley's.

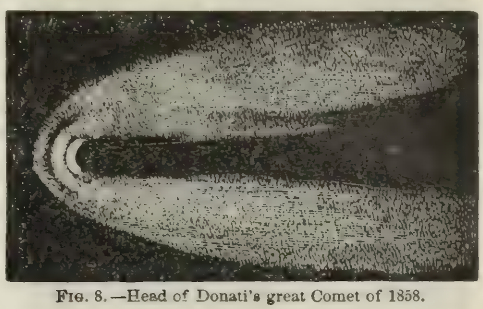

FIG. 8. —Head of Donati's great Comet of 1858.

Meteors are luminous bodies occasionally seen moving rapidly through the atmosphere. They consist of combustible matter, and some of them measure several thousand feet and are sometimes called shooting stars. They appear mostly in August and November, come suddenly, and are extinguished generally without noise.

METEORITES, also called aerolites, are sometimes attended with a loud, hissing noise, sometimes like the report of a cannon. They are composed of metallic substances, as iron, nickel, etc. They fall to the earth, sometimes in large masses and sometimes in showers of stones. One of the aerolites in the British Museum weighs over 8,000 pounds.

FIXED STARS. — They are called fixed because they are not seen to move like the planets, although undoubtedly they are all subject to motion. About seven thousand can be seen with the naked eye, and millions with the aid of telescopes.

There are countless stars in those distant regions of space known as the sidereal heavens.

Our sun is but one out of those myriads of stars, shining by their own light; and each of these is performing in its sphere the same important functions to the worlds revolving around its concentrated heat and light which the sun performs for us.

The fixed stars are classified according to their brightness; the brightest are of the first magnitude, and so on.

The stars of the sixth magnitude can be seen with the naked eye, while those from the seventh to the seventeenth magnitude can be seen only with the telescope, and are called telescopic stars.

The stars are immensely large bodies. Those belonging to a group are designated by Greek letters, after which Roman letters, and lastly figures are used. Their distances from us can only be approximately measured, but they are supposed to amount to trillions of miles.

THE MILKY WAY OR GALAXY is one great circle entirely surrounding the heavens, in which telescopic stars are very densely crowded together.

BINARY stars are double stars which seem to revolve about each other.

Star clusters are masses of stars so nearly in a line of view that only large telescopes can show them to be separate stars.

Many clusters, which appear like cloudy specks, contain ten to twenty thousand stars.

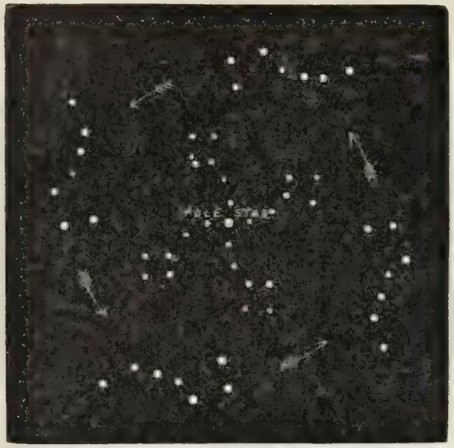

FIG. 9. — THE POLE STAR and the portions of the constellations of Ursa Major (the great bear) and Ursa Minor (the little bear), commonly called the Great Dipper and the Little Dipper, in four positions, which they occupy at interval of six hours in their apparent revolution around the Pole Star.

If each of these stars be a sun surrounded by a train of planets, and each of these suns as far distant from each other as our sun, how vast must be that system, the combined light of whose thousands of suns appears only like a faint haze!

These cloudy spots of light, which the best telescopes cannot resolve into stars, are called *nebulæ* (Latin for clouds). We can see many thousands of them, and of various forms.

CONSTELLATIONS are groups into which stars are divided, because it would be impossible to designate each star by a particular name; they are imagined to be in the form of men, monsters, animals, etc.

Besides the zodiacal constellations already mentioned are those lying north of them, called *northern* constellations, and those lying south, called *southern* constellations.

AN OBSERVATORY is a building designed for the reception of astronomical instruments, and for making observations on the heavenly bodies.

TELESCOPES are optical instruments which serve for discovering and viewing distant objects. They are divided into two classes, viz.:—

REFRACTING telescopes, consisting of lenses through which the objects are seen by rays refracted through them to the eye. The lens or glass turned towards the object is called the object glass, and that next to the eye the eye-glass.

REFLECTING telescopes, or those which represent the images of distant objects by reflection, chiefly from concave mirrors.

A MICROMETER serves for measuring distances in the field of view.

A TRANSIT INSTRUMENT is a telescope so mounted as to observe the passage of a heavenly body across the meridian.

* THE ASTRONOMICAL CLOCK is an instrument by which exact time may be ascertained to the hundredth or even thousandth part of a second.

THE MURAL CIRCLE is an instrument used to determine the declination of the heavenly bodies.

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* This clock shows the sidereal time. A sidereal day is the time occupied by one complete rotation of the earth on its axis.

GEOLOGY

GEOLOGY treats of the structure and origin of structure of the earth; and its object is the comprehension of the earth's history. It is not, as many suppose, antagonistic to the Bible, inasmuch as the truths, relative to the origin and history of the earth, demonstrated by this science, have been found to harmonize with accurate Bible interpretations of the same.

Before considering the construction of the crust of the earth, it is necessary, in order to make a clear presentation of the subject, that we should commence with a brief description of *rocks*, the characters of some of the common kinds of which are as follows: —

Limestone, Magnesian Limestone. — These rocks consist principally of animal remains, and are of different colors: white, black, gray, red, yellow, and brown. Their texture varies from that of flint to a coarse granular substance, and they are distinguished from other rocks by their relative hardness, by their effervescence with acids, by easily yielding to the pressure of a knife point, and by crumbling when heated. Chalk and ordinary marble are limestone. Calcareous rocks — from the Latin word *calx*, meaning lime — include the different kinds of limestone.

Conglomerate or Pudding-Stone is merely gravel-bed solidified. Gravel is a mixture of sand and small stones. The stones that go to make up gravel are mostly quartz, with occasionally a mixture of limestone and other hard rocks.

Sandstone is consolidated sand. The sand on sea-shores is generally quartz; when it becomes solidified in beds, it is sandstone. The glistening lustre which we sometimes observe in sand is caused by scales of mica which it contains.

Shale is a rock mainly composed of clay, which has a tendency to separate into slaty fractures, the plates when separated being thinner and more easily broken than true slate. The common color of the shale rock is black, from the fact that the animals and plants that live in mud contain carbon, portions of which they contribute to the mud. When the black shale is burnt, the animal or vegetable substance contained in it is consumed, and the shale becomes nearly white. White quicklime is obtained from black limestones for a similar reason.

Mud is made up of decomposed and pulverized rock.

Clay comes from the pulverizing of such rocks as granite, gneiss, etc., also from their decomposition; it consists chiefly of feldspar, and often contains iron.

ARGILLACEOUS OR CLAYEY SANDSTONE is that made from sands which are clayey, when solidified. When this sandstone breaks into thin slabs, it is said to be *laminated;* and the slabs, when sufficiently hard, are used as flagging-stones for sidewalks.

SLATE is a kind of argillaceous shale, from which it differs in being firmer and in breaking more evenly.

GRANITE is a crystalline rock composed of crystalline grains of quartz, feldspar, and mica The quartz grains are generally of a gray or glassy lustre, and have no cleavage. The grains of feldspar show smooth, sparkling surfaces, with cleavage in two directions. Their color is generally white or flesh-red. The mica is usually in white, black, or brown scales, which may be separated with the point of a knife blade into thin layers.

GNEISS is similar in composition to granite, with the mica arranged in layers; it splits readily in the direction of the mica layers into slabs, which fact causes it to be termed *schistose* rock (from a Greek word meaning to divide).

MICA SCHIST differs from granite and gneiss in having a greater abundance of quartz and mica. From the preponderance of the latter, mica schist readily divides into thin layers. It is called *mica slate* when the scales of mica are not plainly visible.

It is sometimes difficult to determine whether a rock should be called granite, gneiss, or mica schist, because the shadings through which they pass into one another are often so indistinctly defined.

SYENITE is a rock resembling granite, but containing hornblende instead of mica. Hornblende has a black or greenish-black color, and on account of its brittleness will not split into thin layers. This fact enables us to distinguish syenite from granite.

SYENITIC GNEISS is similar in structure to gneiss, but contains hornblende in place of mica.

HORNBLENDE SCHIST is a slaty rock of a black color, and is almost wholly composed of hornblende.

IGNEOUS OR ERUPTIVE ROCKS are those which have come to the surface in a melted state, either through fissures in the earth's crust or from volcanoes. The trap rock belongs to this class. It is a heavy rock, of a dark color, and is somewhat crystalline in texture. The Palisades on the Hudson above New York are trap rocks, as are also many ridges in the neighborhood of Lake Superior, the Giant's Causeway in Ireland, and Fingal's Cave in Staffa on the western coast of Scotland. When trap is composed of very fine grains, it is sometimes called *basalt.* The word *trap* is derived from the Swedish word *trappa*, a stair, on account of the rocks frequently occurring in the form of huge steps.

AMYGDALOID (from a Latin word meaning almond) is a species of trap rock which contains small knots or lumps composed of different minerals. These knots fill the holes that were made by expanding vapors while the rock was in a state of fusion.

VOLCANIC ROCKS are those which are composed of lava, and have come to the surface in a state of fusion from a vent called a *crater.* The volcano or burning mountain is made from eruptions which occur around the crater.

TRACHYTE is a volcanic rock of a pale grayish-blue color, coarse in its texture, and peculiarly rough to the touch on the surface.

PORPHYRY is a species of igneous rock containing some crystals of feldspar. It is close in texture, and has a smooth surface.

The rocks formed out of pulverized volcanic rocks, or cinders of an earthy nature, are called *tufas.* They vary in color, but are usually brown, gray, or yellowish brown.

STRATIFICATION OF ROCKS.

Rocks are divided into two great classes, *stratified* and *unstratified.*

Stratified rocks are those which are composed of strata or layers placed one upon another. In some of these rocks we may find, for a bottom layer, sandstone; next to it, shale; then limestone; then shale and limestone in alternate layers, the top limestone stratum differing materially from those below. In stratified rocks the succession of strata often varies. In some cases we may have shales and conglomerates alternating; in others conglomerates and limestones, or shales and sandstones. The thickness of each layer ranges from a few feet in some rocks to hundreds of feet in others.

The layers were made in the order of their position, beginning with the lowest, and the different layers mark different intervals of time in geological history.

Stratum and *layer* are not to be understood as synonymous. A layer consists of only one bed in a stratified rock; while a stratum may consist of many layers of the same kind lying together.

A *formation* is composed of several strata deposited in the same period, which have a general likeness in their organic remains. A thin layer coming among the layers of a rock, and differing from them in composition, is called a *seam.*

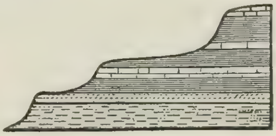


Fig. 1.—Stratified Rock, showing Layer and Stratum.

The most common kinds of stratified rocks are limestone, sandstone, shale, and conglomerate. Gneiss and mica, though of a crystalline texture, are also of the nature of stratified rocks.

Unstratified rocks are those which are not made up of layers. Among the igneous rocks are many examples of the unstratified. Most granite is of this character, showing no distinct traces of beds or stratification. The trap rocks, as exemplified in the Palisades on the Hudson, the Giant's Causeway, and Fingal's Cave, bear no marks of stratification. Igneous rocks which are composed of successive deposits of lava are stratified; but the term is generally applied only to those kinds not of igneous origin.

Narrow plates of rock intersecting other rocks are called *veins.* They are usually irregular in form, and vary in their ingredients.

FORMATION OF ROCKS.

We shall now briefly outline the processes of rock formation. Rocks have been made in various ways, and they may be classed as follows:—

1. *Rocks formed by fusion*, which include igneous rocks. Their texture is crystalline, the grains as a rule being so minute as not externally to appear to have the forms of crystals.

2. *Metamorphic rocks*, or those fragmental rocks that have been metamorphosed or altered. Shales, sandstones, conglomerates, and limestones have been altered to crystalline rocks, such as gneiss, granite, mica schist, etc.

3. *Rocks made wholly or partly of the remains of plants or animals;* as limestones, sandstones, shales, and coal and peat beds.

4. *Rocks formed by deposition from waters holding the material of them in solution.* Waters which hold particles of lime in solution deposit it, and thus make a kind of limestone. So it is with waters that are calcareous or silicious, making by their deposits beds of calcareous tufa and silica. Waters which percolate through the roofs of caverns formed of limestone sometimes evaporate on the roof, and form conical pendants of limestone

called *stalactites;* when they evaporate on the floor of the cavern, the limestone which they produce is called *stalagmite.*

5. *Rocks made by the agency of waters and winds* (exclusive of limestones), as shales, conglomerates, and sandstones. The mud, gravel, and sand of which such rocks are composed was deposited by the waters of the ocean or rivers as a sediment, and hence such rocks are called *sedimentary.*

The most effective agents in past time in producing the fragments of which sedimentary rocks are composed were the ocean, rivers, and winds. The sun's heat, air, and moisture have aided materially in reducing rocks to fragments, thus rendering the material ready for the waters and winds to take up.

The ways in which rocks are made through fusion are exemplified in the action of volcanoes. When the fissures from which igneous rocks come (as heretofore described) are closed by one eruption, the melted lava forms beds of rock in the region over which it flows; but when several eruptions follow one another, the vent becomes the centre of a volcano or burning mountain. The melted rock and cinders which it ejects form a mountain somewhat conical in shape.

Active volcanoes (see Physical Geography) in their eruptive periods generally send out streams of lava through fissures in the sides of the mountain, and occasionally over the edge of the crater. Cinders are also sent up from the crater to a great height, and come down in showers around it. Eruptions are caused by waters getting access to the melted rock through fractures. The vapor causes the liquid mass to expand and break the mountain. The cinders which issue from volcanoes form *tufa*, a kind of soft sandstone.

Deposits of silica are often made by hot springs. The heat enables the waters to make a solution with particles of the rocks with which they are in contact.

Some sandstones have been solidified by lime salt in solution in water, which was derived from grains of corals, shells, etc., in these rocks. Limestones have been similarly affected.

Heat has helped to solidify the more solid of the shales and sandstones, the silicious waters produced by heat being a potent factor.

Long-continued heat has crystallized as well as consolidated rocks, and has changed shales, sandstones, and conglomerates into gneiss, granite, mica schist, etc.

Many minerals may be made and crystallized through the action of moisture when at a high temperature, and thus become elements of altered deposits when not originally present; such are hornblende, feldspar, and mica.

That *metamorphic heat* was usually lower than that of fusion is apparent from the fact that the rocks retain their stratification. In some cases the planes of stratification were wiped out, which shows that the heat was intense enough to soften the rock, and thus make granite in place of gneiss out of shale. Metamorphic heat has sometimes changed limestone impurities into grains of mica and other minerals, and has also changed compact limestones full of fossils into marbles of different colors. Hot springs or geysers make large silicious deposits in the form of opal, and also petrify wood.

The heating and cooling of the surfaces of rocks cause an expansion and contraction which tends to loosen the grains of which they are composed; and this, added to the action of air and moisture, helps to make earth or gravel for the formation of rock deposits. When the rocks beneath any region become heated, their expansion results in an elevation of the surface, and the loss of heat produces an opposite effect.

Plants and animals have contributed materially to rock making. After the death of the animal, the remains pass to the mineral kingdom, and from the remains nearly all the limestones have been made. The animal remains that have aided most in the formation of limestones are shells, corals, crinoids, and foraminifers.

Shells are made from secretions of the animals, and are used to protect the soft body which they enclose. Corals and crinoids are found exclusively in the ocean. Shells, corals, crinoids, and foraminifers are made almost wholly of carbonate of lime, and where solidified make limestone. Generally the corals were ground by the action of the currents and waves to sand or mud, and hence rocks and reefs made from it show little trace of the coral; occasionally, however, a fragment of coral may be found.

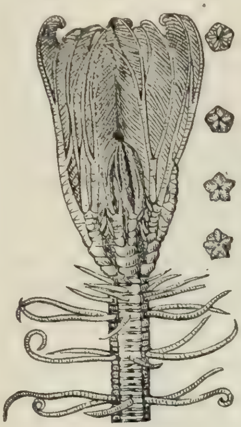


FIG. 2.—Crinoid.

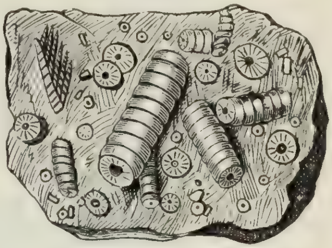


FIG. 3.—Piece of Limestone showing Fossils of Crinoids on the Surface.

A fine-grained rock is made from foraminifers without any grinding, the animals being very minute in themselves. Chalk is almost wholly made of them, and is now making over the bottom of the ocean. Some seaweed plants secrete lime, and have aided in the formatiom of rocks. The principal are corallines, nullipores, and coccoliths.

The kinds of limestone made from animal remains are soft marl or calcareous earth, compact limestone of various colors, and chalk. Limestones are made from the remains of crinoids and shells, in a manner similar to that from corals; but the rate of formation is slower from shells than from corals or crinoids, because shells produce much less carbonate of lime in proportion to their size.

Very minute plants and animals often contribute largely to rock formation. Many of them make secretions of silica in place of carbonate of lime, and thus form beds of silica. The plants which help to form silicious beds are called *diatoms*. The beds formed by them have the appearance of fine chalk, and the material is frequently used as a polishing powder.

Rhizopods and most sponges make silicious shells, and flint is nearly pure silica. It has been made mainly out of spicules of sponges and diatoms, the particles of which were dissolved by the cold waters, and again solidified by the saline ingredients of the water.

Besides the animals enumerated, various others have contributed to the formation of rocks: for instance, the bones of quadrupeds of different kinds, the bones and feathers of birds, and the bones and scales of fishes and reptiles; also parts of insects, worms, shrimps, crabs, etc.

Nearly all rocks when exposed to the action of *air* and *moisture* become altered. The carbonic acid and oxygen which air and moisture contain act chemically on rocks, and cause many of them to crumble to sand or change to clayey earth. The most durable rocks are the firmer kinds of slate, gneiss, and some hard conglomerates. The destruction caused by air and moisture to the exposed parts of rocks renders them in a measure prepared for removal by moving water and ice; and thus it is that the soil of the earth has to a large extent been made.

The work of the *ocean* in the formation of rocks has been carried on by means of its tides, its waves, and its currents. The ebbing of the tide allows the rivers to carry out their detritus or sedimentary matter to sea, but its inflow reverses this movement, and makes the waters of the rivers drop their detritus either about their mouths or along the adjoining coast.

The action of the waves on the beach grinds the stones against one another, and finally reduces them to sand. The retreat of the waters under the incoming wave carries with it the finer sand, and leaves the coarser to form the beach. The sand on the beach consists of hard quartz grains, while that carried into the deeper waters is made up of feldspar and other softer minerals, so that wherever sand beds are formed there must be mud beds in their neighborhood.

Soft sandstones and beds of gravel are easily removed by waves, while the harder kinds of granite wear slowly. The rugged cliffs on most rocky shores show the effects of storm-driven waves.

In tropical seas, mollusks are ground to a fine powder, and the resulting deposits, when hardened, make limestone; its fossils are the shells that escape the grinding. Coral-reef rock is formed by the waves tearing up corals, carrying them to the beach, and there grinding them to powder, which when hardened becomes true limestone.

As oceanic currents alone can carry only the finest detritus, their depositions must be of the same kind, and consequently no coarse sandstones or conglomerates can be made from them. Ocean currents often, by means of *icebergs*, distribute the coarsest of rock material. The deposits made by icebergs are made up of gravel, sand, and stones of all sizes.

The ripples raised by waves and gentle currents in ancient times are often preserved in the rocks, and their appearance is an evidence that the sands of which the rocks were there formed were accessible by waves or gentle currents.

Fresh running waters have contributed in a large degree to the formation of rocks. No sooner do the waters of the clouds reach the ground than they begin carrying away grains of earth from the slopes and rocks. Torrents tear up and carry with them both earth and rocks. As the torrent becomes less violent in its flow, the stones and coarse material sink to the bottom, while the finer material is carried by the rivers to the ocean.

The material which rivulets and rivers carry is, as a rule, pulverized rock, so that their mud often consists of the very same minerals as the granite or gneiss from which it was derived. Most of the shales and slates are made from the muds or clays of this kind. Sometimes the quartz sands are left by themselves and the finer ones carried to make deposits of their own, and in this way the deposits are made to differ somewhat from the rocks whence they are derived.

Rocks in process of decomposition, containing iron, often have the iron washed out of them and deposited in low places, making beds of cellular limonite, called *bog iron ore*. The iron is generally in solution as bicarbonate when carried by the waters, and the change to limonite is made where the waters stand and evaporate.

The loose sands composing a sea-beach are taken up by the *winds* and formed into ridges higher than the sea-beach. Some of them have been solidified and show lamination, but irregularity in their formation, showing that they have often been partly cut down by storms and again filled up by the winds.

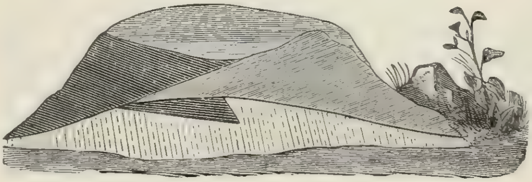


FIG. 4.—Sand Hill, showing Irregularity of Lamination produced by the Winds.

Water performs part of its geological work when in the condition of *snow* and *ice*. As is well known, when water freezes it expands; and when this expansion takes place in the crevices of rocks, it has a tendency to break them apart, and affords air and moisture additional chances to carry on their work of destruction.

When a river is frozen over, the ice often envelops stones along the shore. When the stream is raised by floods and the ice is broken up, the ice and stones float down with the current, or are spread over the river flats. Ice, when thick, by its expansion, pushes with great force against the shores, moving what is movable on them, and sometimes even displaces the bank. The greater geological work of ice is done, however, by glaciers.

Glaciers are huge accumulations of ice which descend from snow-covered elevations along valleys. From the melting ice in each glacier a stream flows, which, beginning high in the mountains, tunnels its way through the ice in its course, and finally rushes forth torrent-like. Earth and stones are torn away by the sides of the glacier, and are carried by the ice to where it melts and there dropped. The bottom of the glacier also carries with it huge blocks of stone or earth. The cliffs and ledges in the vicinity of glaciers are planed and rounded on their exposed surfaces by the glacier moving against or over them. These rounded rocks are called *sheep-backs*, or *roches moutonnées.* The fine powder which is produced by the grinding of the stones against one another makes, when deposited, what is called *bowlder clay.*

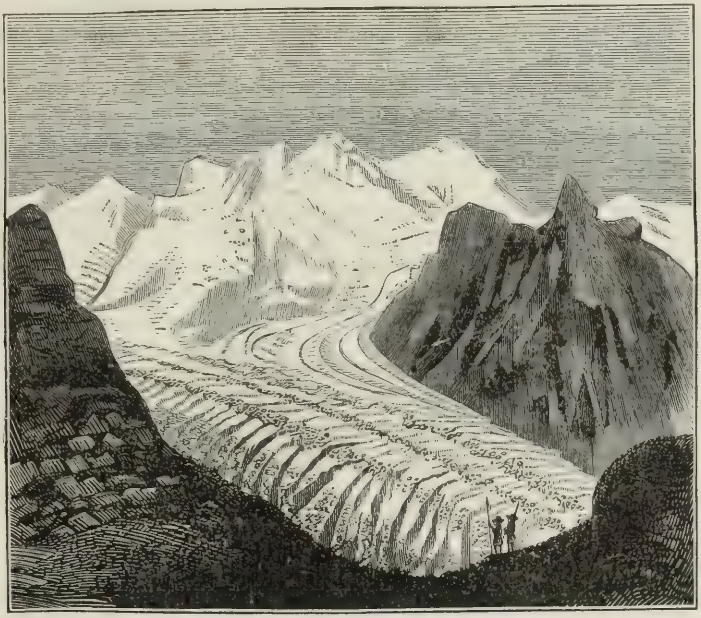


FIG. 5. — The Glacier.

It will be readily seen that glaciers, therefore, are very effective in widening and deepening valleys, and occasionally in damming up streams.

Ice does considerable geological work when in the form of floating ice or *icebergs.* An iceberg is simply a glacier broken off at the sea, and they are the means of transporting stones and earth from one region to another, which, where deposited, assist in the formation of other rocks, as has been heretofore shown.

VALLEY AND MOUNTAIN MAKING.

VALLEYS are made principally by what geologists term *erosion;* that is, the wearing away of earth and rock by water. The water usually comes from the mists and rains about the higher parts of mountains. Streamlets are first made, which gather into streams as they descend, and finally form into torrents as they near the base; and there, as a consequence, the valley first takes shape. After some time the stream ceases to erode or eat away much at the bottom, and begins to eat away laterally, especially during freshets, undermining cliffs on either side, and thus widening the valley. The process of valley making is plainly and simply exemplified by the action of rains on the earthy slopes along a roadside; and thus it is by the action of running water that most of the valleys of the world have been formed. The direction of valleys has sometimes been predetermined by fractures of the earth's crust; but the stream, though thus guided in its original course, has afterward carried forward its work of erosion.

Valleys are also made by the upheaval of mountains. Every upheaval has its corresponding depression. This is exemplified in all the great valleys over this continent; the Mississippi Valley, for instance, being a depression between the Rocky Mountains on one side and the Alleghanies on the other.

MOUNTAINS are made in several ways, one of which has already been spoken of; viz., that of igneous ejections from volcanic vents or fractures. The most important method, however, by which mountains have been formed, has been by bendings of the earth's crust, and by upturnings and flexures of rocks. The cause of the flexures in the rocks of mountain regions was the *lateral* pressure within the earth's crust; no other kind of pressure would make the succession of folds which they exhibit. This lateral pressure is attributed to the fact that the earth was once a molten mass, and that since the formation of its crust by the cooling of its surface, a continued contraction has been going on beneath it, and a tendency to draw it downward. This would necessarily, from its globular shape, cause a pressure of the parts against one another; and if the crust possessed any flexibility, uplifts and flexures would result. This truth is illustrated on most continents, their borders being high and their interiors low.

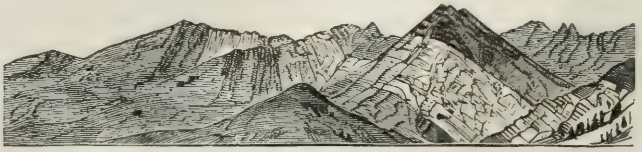


FIG. 6. After Hayden. — Upturned Strata of the Elk Mountains, Colorado. The light-shaded stratum is Triasso-Jurassic; that at its right is Carboniferous; at its left, Cretaceous.

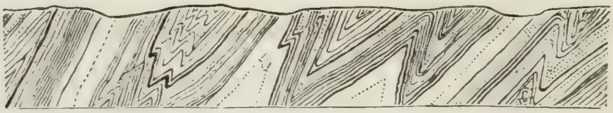


FIG. 7. After Logan. — General View of Folds in the Archæan Rocks. Contortion of Laurentian Strata.

Most great mountain chains are found near the oceans, — a position which is accounted for by the fact that the crust of the earth beneath the bed of the ocean is lower in level than that of the land, and that the sides of the depression are abrupt toward the continents. The consequence is that the lateral pressure from the direction of the ocean has been upward in an oblique direction; hence the formation of mountains at the borders of the continents.

When the earth's crust had become too stiff to bend readily, there was little upturning produced by lateral pressure, but extensive igneous ejections and considerable fracturing.

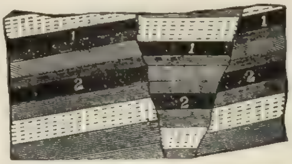


Fig. 8. — Fractures and Fault.

Sometimes when fractures take place, a double fracture occurs, and the middle portion is displaced by dropping a little lower than the corresponding strata on each side, as shown in Fig. 8; this displacement is called a *fault*.

Many mountains are formed by the erosion of elevated plateaus of horizontal rocks. The eroding power of torrents has so ridged and sculptured the plateaus as to reduce them to a region of deep valleys and precipitous mountains.

HISTORICAL GEOLOGY.

THE different ages in geological history are not strongly defined in the rocks. The rocks are but the accumulations of the relics of the age they represent, and their history is in general different in each continent. Every transition or change in the strata, especially where there is a striking change in the organic remains, denotes a transition in the era from one set of circumstances to another; and all such transitions mark great events in the history of a continent, and divide the era into periods, and sometimes subdivide the period into epochs.

Geologists have been able to make a continuous history of rocks from the remains of plants and animals that have been found in them, there being a succession in the species that have lived upon the globe.

For a long period after life was abundant, there were no fishes. When, therefore, a rock is found in which a fish is fossilized, it is inferred that the rock does not belong to the formations of that early period, but to one of some later time. After the first appearance of fishes, the kinds changed as time progressed; so that if we can ascertain the class to which the fossilized fish belongs, we can determine approximately the age of the rock in which it was embedded.

If a stratum be found which has no fossils, the geologist traces it to another region, where he hopes to find them in at least an upper or under stratum.

Geological history has therefore been divided into four great periods, as follows: —

ARCHÆAN TIME, which means ancient time.
PALÆOZOIC TIME, the period of the earliest forms of life.
MESOZOIC TIME, the period of the middle forms of life.
CENOZOIC TIME, the period of the recent forms of life.

Since the fossilized remains of animals aid us in determining the ages of rocks, we will here state the five subkingdoms into which animals have been divided: —

1. PROTOZOANS, or *first animals*, which include the lowest forms of animal life; as rhizopods and sponges.

2. RADIATES, or those animals whose parts radiate around a centre; as corals, crinoids, etc.

3. MOLLUSKS, or those animals having soft, fleshy bodies protected by an external shell; as the oyster, snail, and cuttle-fish.

4. ARTICULATES, or those animals whose bodies are made up of segments jointed together; as butterflies, beetles, spiders, lobsters, etc.

5. VERTEBRATES, or those animals having backbones; as fishes, birds, the horse, whale, etc.

ARCHÆAN TIME.

THE first condition of the earth, as indicated by geology, was that of a globe of liquid or molten rock, enveloped in vapors. Then a cooling process began, and the earth became condensed at its centre, gravitation and superincumbent pressure causing the solidification. As the cooling process continued, an external crust was formed, and finally the condensation of the vapors produced an envelope of waters. This crust has since continued to cool and increase in thickness.

Admitting the fusion theory as a fact, we reasonably conclude that this watery envelope in contact with the heated crust would produce erosion by chemical action; hence after a time sedimentary deposit would form new crust on the original crust. The rocks made out of that second crust are the Archæan rocks of which geology treats. They extend over the whole globe, and are in fact the only universal formation outside of the original crust.

The largest area of exposed Archæan rocks in North America extends from Lake Superior to the Arctic Seas. They are also found in Northern New York, in New Jersey, portions of Pennsylvania, Virginia, and in several sections of New England. They form the great outlines of the continent, the rest of it being under water.

Archæan rocks have also been found in Finland, Norway and Sweden, and in Northeastern Scotland. They comprise gneiss, granite, and mica schist, also hornblendic rocks and crystalline limestone. One of their striking characteristics is an abundance of iron ore, and the Archæan is sometimes called the Iron age. A form of carbon called *graphite* is commonly found in them.

The Archæan rocks were, like other sedimentary deposits, originally laid in horizontal beds, and their present upturning shows that they were subjected to the same disturbances that attend the making of mountains. One of the principal means of distinguishing rocks of this age is from the existence of thick beds of iron ore in them, and the presence of titanium, which is not usual in iron ores of later date.

The age of Archæan rocks has been called the Azoic age, from the fact that no forms of life have been found in it. The presence of graphite in large quantities is evidence, however, that plants of some kind were abundant. Graphite is an essential element of mineral coal, and mineral coal was formed from plants. We infer, therefore, that vegetable life of the sea-weed kind existed.

The fact that limestone strata occur so frequently is considered evidence of the presence of plants or animals, because limestones are nearly all of organic origin. It is now considered that rhizopods were abundant, they being the simplest of all animal life.

PALEOZOIC TIME.

PALÆOZOIC time has been divided into three ages: the *Silurian* (which is subdivided into the Lower and Upper Silurian), the *Devonian*, and the *Carboniferous.*

THE LOWER SILURIAN.

THE principal rocks of the Lower Silurian era are sandstones, limestones, shales, and conglomerates. The Potsdam sandstone, so called from a locality in Northern New York, formed the first layer on the Archæan rock, and from its thus being first in order it is called Primordial.

The Trenton limestone, so named from Trenton Falls, near Utica, New York, is the most extensive limestone formation in the world, stretching along the range of the Appalachians in New York and Canada, in the States included in the Mississippi basin, and in Western New England. In New York it is divided into the Black River and Trenton limestones, and the same divisions are apparent in Canada and in portions of the States west of New York.

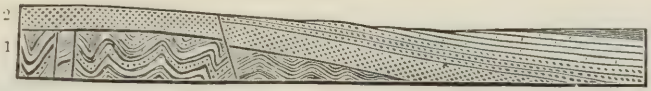


FIG. 9.—Section of the South Side of the St. Lawrence. Primordial unconformable strata on the Archæan. 1. Archæan or Laurentian. 2. Lower Silurian.

The color of Trenton limestone is grayish black to black, the black being due to carbonaceous substances. It is sometimes found bituminous.

The plants found during the Trenton period are all sea-weeds, and the animals all invertebrates. Protozoans, radiates, mollusks, and articulates are all represented, the earliest life being largely made up of crinoids, worms, brachiopods, and trilobites. The animals that existed in the Primordial or first period did not exist in the second; and those that existed in the earlier part of the second did not exist in the third.

Subterranean movements and metamorphism interrupted the close of the Lower Silurian period, and caused mountains to be made. The limestone and other fragmental rocks overlying it were crystallized and folded by the heat which the disturbance produced, and were changed to metamorphic rocks; the mud beds were changed to gneiss, mica schist, and other crystalline rocks, and the fossiliferous limestone to architectural marble.

The maximum thickness of the Lower Silurian rocks in the Green Mountain region was not less than 20,000 feet, while those of Great Britain were over 40,000 feet.

THE UPPER SILURIAN.

The rocks of this era are sandstones, conglomerates, shales, and limestones. During what has been called the Niagara period, one of the greatest limestone formations of ancient time was in progress, and is called the Niagara limestone. It extends over the greater part of British America and Western New York, and southwest along the Appalachian range to Tennessee.

The Wenlock shale and limestone of Great Britain are of the age of the Niagara, and are also full of fossils.

The Lower Helderberg formation followed the Niagara, and extends through the greater part of the Mississippi Valley.

The Niagara limestone is often concretionary in structure; that is, composed of different materials: and in the greater part of the West the fossils are silicious.

At Chicago, mineral oil occurs in large quantities in Niagara limestone, though it cannot be advantageously collected.

Sea-weeds are the principal fossil plants found in this period, though a few terrestrial plants existed before its close. Corals, shells, crinoids, and trilobites abound, but no evidence of fishes has been noticed until near the close of the era.

From the beginning to the close of the Silurian period, the rocks in the interior of North

America were principally limestones; while those of the Appalachian region were principally sandstones, conglomerates, and shales. Many of the sandstones contain ripple marks, mud cracks, etc., which show that they must have been made in shallow waters, and that the deposits were often exposed above the water's surface.

THE DEVONIAN AGE.

The Devonian Age, or *Age of Fishes*, was so named from South Devon in England, where such fossilized rocks occur.

The great limestone formation of the Devonian was the *corniferous*. It extends through New York, and stretches westward to the Mississippi and the Missouri.

In many places the limestone is a coral-reef rock; and at the falls of the Ohio, near Louisville, Kentucky, it is composed of an aggregation of corals of large size, and some standing in a growing position. This shows that a large part of the continent was covered with shallow coral-growing seas, for the large corals would only form limestones where they were within reach of the waves. This limestone often contains *hornstone*, which shows that sponges and diatoms were making silicious shells which aggregated into masses of hornstone.

The Upper Devonian consists of the deposits made after this limestone, which are called the Hamilton, Portage, and Chemung beds, from the localities in New York where they are found. They are principally sandstones and shales, and the conglomerate and sandstone which are above them is called the Catskill group.

The Hamilton beds at Kingston on the Hudson afford the best flagging-stone of the country.

In the middle and latter part of the Devonian age, large forest trees were plentiful; conifers abounded, as also did ferns, lycopods, and calamites.

The facts gathered with reference to the progress of the age show that trees were mostly without flowers; that the seas abounded in corals, crinoids, and trilobites; and that great fishes, such as sharks, gars, placoderms, and ganoids, disported in the waters, while swarms of insects covered the earth.

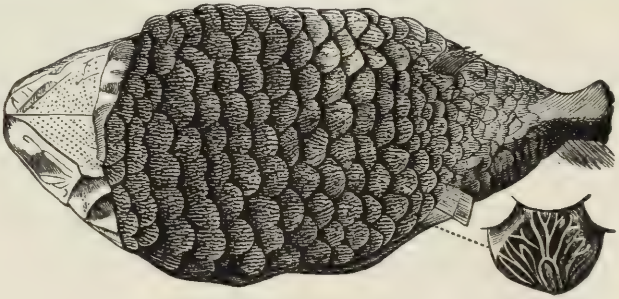


Fig. 10. — A Ganoid, and one of its Scales magnified.

During the Devonian age there was no perceptible tilting of the rocks, though the limits and depths of the interior sea were materially changed. The growth of the dry land of the continent continued southward, and the greater part of New England, Wisconsin, and the borders of the adjoining States, were above the waters.

THE CARBONIFEROUS AGE.

The Carboniferous Age was the period when the coal fields of Europe and America were formed. At the beginning of this age the greater part of North America and Europe was under water, and during it sand beds and limestone strata were in process of formation. The limestone thus formed has been called *crinoidal* limestone, from the fact of its being in a great measure composed of crinoids. This portion of the age is called the *subcarboniferous.*

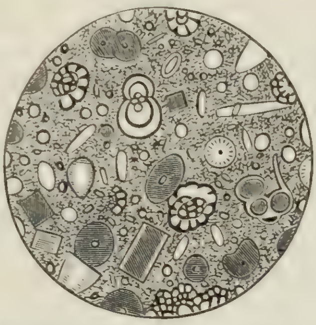


Fig. 11. — A Thin Piece of Carboniferous Limestone as it appears under the Microscope, showing that the rock is almost wholly composed of animal remains.

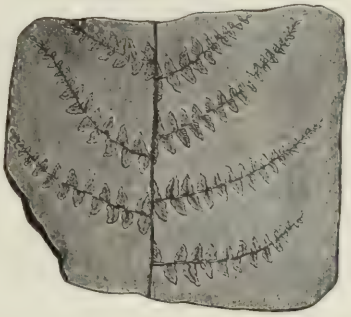


Fig. 12. — Fossil Leaf on Shale.

The period of the *coal measures* began after the subcarboniferous. The basal rock of the coal series is the millstone grit, and is generally a conglomerate. The rocks of this period are mostly shales, conglomerates, and sandstones, with some limestone strata intervening.

The fossils of the coal beds are mostly fresh-water plants, and each coal bed was originally a bed of vegetable material. This bed of vegetable matter, increased till many times thicker than the coal bed to be made out of it, was eventually covered with beds of clay or sand, and while thus covered it gradually changed to coal. The atmospheric oxygen is excluded when the material is under water, except the small part contained in water. With this small supply, part of the carbon and hydrogen escape oxidation, and the product is *coal.* There is often a clayey layer in the rock under a coal bed, which is called the *underclay*, and which is generally full of the stems and roots of plants. A little sulphur is always present in the coal beds, which generally comes from pyrites, which is a compound of iron and sulphur.

The coal found in the greater part of this country is almost wholly bituminous, with the exception of that of Pennsylvania and Rhode Island, which is anthracite. Anthracite is lustrous and has but little flame when burning, while bituminous has little lustre and burns with a yellow flame.

The coal beds of the United States are estimated to cover 120,000 square miles. They are found in the States separated by the Mississippi Valley, in the Alleghany region, from Southern New York to Alabama, in Central Michigan, and to some extent in Rhode Island.

The thickness of a coal bed varies from less than an inch to thirty or forty feet, there being a vein of anthracite at Wilkesbarre, Pa., twenty-nine feet thick.

The coal period was a time of great forests and jungles and abundant foliage, with few or no flowers. The higher class of cryptogams, ferns, lycopods, and conifers flourished; while low orders of insects, scorpions, crustaceans, and worms abounded. Trilobites and crinoids, sharks and ganoids, inhabited the waters, but no birds or mammals yet appeared. Traces of reptiles are found in this period which indicate that they were much larger than those of our day.

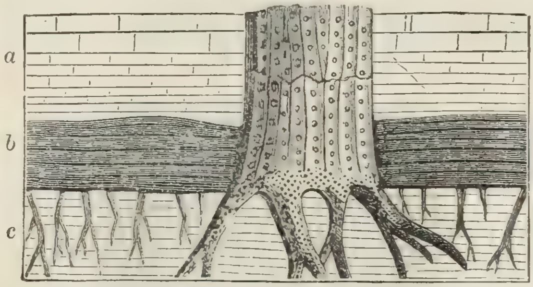


FIG. 13. — Coal Seam as seen in the Face of the Working of a Coal Mine. (c Underclay, with roots passing through it; (b) Bed of coal; (a) " Roof" of the coal, composed of sand and shales, with upright trunks of trees passing through it.

The only mountain region which emerged during the Palæozoic age is that of the Green Mountains; but in the disturbance which closed the Palæozoic time the Alleghany Mountains resulted. Over the Appalachian region, deposits of great thickness had been making during the Silurian, Devonian, and Carboniferous periods. These deposits were in a basin made by the gradual sinking of the earth's crust; for the sandstone at the bottom of the series shows that it was made in shallow waters. This sinking of the earth's crust to the depth of seven miles, and the accumulation of sedimentary beds in it, show that the crust rested on liquid rock. The penetration of heat into the crust, and the pressure from the ocean resulting from the earth's contraction, brought about a break below, pressed together the deposits in the great basin, and thus raised the upper surface above its previous level, forming the Alleghany Mountains.

MESOZOIC TIME.

MESOZOIC or MEDIÆVAL TIME comprises only one age, *the Age of Reptiles.* This age is remarkable for the culmination and decline of two great tribes in the animal kingdom, mollusks and reptiles; also as the time of the appearance of the first mammals, the first of the osseous fishes, and the first birds. Mesozoic time is divided into three periods: the *Triassic*, the *Jurassic*, and the *Cretaceous.*

The Triassic period was so named on account of the three subdivisions which the rocks in Germany present.

The Jurassic takes its name from the Jura Mountains, on the west of Switzerland.

The Cretaceous is named from the Latin word *creta*, chalk, the formation comprising the chalk beds of the Continent of Europe.

The rocks are principally red sandstones, and are found on this continent only on the Atlantic border east of the Appalachians, and on that portion west of Missouri. The narrow areas which these rocks cover, run from the Gulf of St. Lawrence southward, parallel with the Appalachians. From the fossils which they contain, which are fresh-water, we infer that the ranges of sandstone were formed in valleys to which the sea did not have access.

Jurassic beds having marine fossils are found in the region of the Rocky Mountains overlying the Triassic, and make up in part the Sierra Nevada.

Cretaceous beds are generally soft gray and green sandstones, with rotten limestone and partly compact shell beds. Marine fossils, which generally are an indication of shallow waters, abound in them. The chalk is principally made up of the shells of rhizopods.

The flint of chalk was made from the diatoms of the sea bottom, and from silicious sponges. The forests of Mesozoic time were specially marked by plants that looked like palms, called *cycads*, though they also contained the conifers and tree ferns of the Carboniferous era.

The species called *angiosperms*, so called from having their seeds in a seed vessel, made their first appearance in the Cretaceous beds. They are related to the palm, elm, and maple of the present day. The radiates and corals of this period resembled those of the present day, although they were generally of extinct genera. The highest of the mollusks, the cephalopods, had their culmination in the Mesozoic age, and there were also many species of nautilus.

Among the articulates all the higher divisions of crustaceans were represented, as crabs, shrimps, and lobsters; and the vertebrates included not only reptiles and fishes, but also birds and mammals, all of enormous size. Among the birds was the *Pterodactyl*, with a mouth full of teeth, no feathers, and wings like a bat, having a spread sometimes of sixteen feet. Fishes of the shark tribe were the predominant kind through the era, although *teliosts*, or those bony throughout, appeared, among which are our herring, salmon, and perch.

Throughout all the periods of this age, reptiles were the dominant species, culminating in the Triassic; the labyrinthodon, a frog-like quadruped sometimes as large as an ox, being its highest species.

The *Dinosaurs*, terrible lizards of different kinds, had the hind feet three-toed, like those of birds. They were huge monsters, from forty to seventy feet in length.

The *Ichthyosaurs*, or fish lizards, somewhat resembled birds. They had thin concave vertebræ and short necks, with bodies from twenty to thirty feet long.

The *Plesiosaur*, another enormous reptile, had the head of a reptile, the neck of a swan, and the trunk and tail of a quadruped.

The probability is that birds began in the Triassic period. In the Cretaceous of the United States, the bones of a number of birds have been found fossilized. Of mammals the prevailing species were *marsupials*, or those related to the opossum and kangaroo.

During Mesozoic time the older kinds of fossils are not found, while new ones are discovered in every successive rock stratum. The expansion of the system of life was evident, as in past ages, by the appearance of new species and the disappearance of old.

At the close of the Jurassic period the Sierra Nevada, the Humboldt ranges, and the Wahsatch Mountains were made. Many rocks of the Atlantic border were tilted, and deep fractures made which gave vent to the liquid rock beneath, which on coming to the surface cooled, and formed the Palisades on the Hudson, Mount Holyoke Ridge, and others.

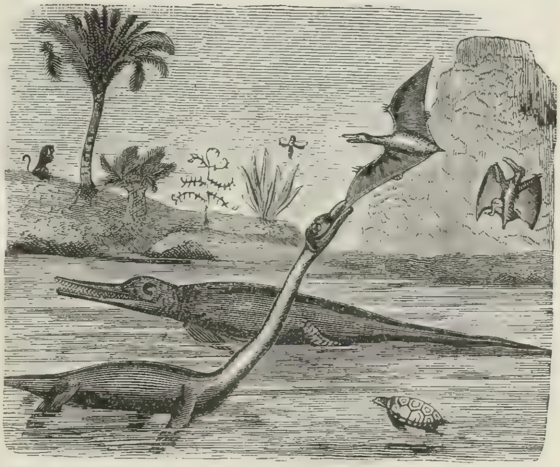


FIG. 14. — Restoration of Saurians, including the Plesiosaurus, the Ichthyosaurus, and the Pterodactyl.

CENOZOIC TIME.

CENOZOIC time embraces two ages: the TERTIARY, or *Age of Mammals;* and the QUATERNARY, or *Age of Man.* Lyell has divided the Tertiary age into three sections, with respect to the number of existing species of animals and plants found in each, viz.: —

The EOCENE, signifying *dawn of the recent*, relating to time in which few present species of animals existed.

The MIOCENE (less recent), in which less than half of the present species existed.

The PLIOCENE (more recent), in which more than half of the present species existed.

The simpler and more logical division is according to time, into Lower, Middle, and Upper Tertiary.

In the early part of the Tertiary period only the borders of the Atlantic, the Gulf of Mexico, and part of the Pacific coast were covered by the sea, and on these portions marine action and rivers were forming Tertiary rocks. Marine Tertiary beds form, together with the Cretaceous, the Coast Range of hills in California and Oregon.

Marine Tertiary beds of the Eocene period were formed on the borders of the Gulf of Mexico, and on the Atlantic coast south of New York. The Miocene appear only on the Atlantic border, and the Pliocene along the coast of South Carolina.

Beds of lignite, or carbonized wood, are found in Mississippi, Tennessee, and Arkansas; also in Wyoming, Utah, and Colorado. These lignitic beds were at one time beds of vegetable débris, the same as are formed in marshes.

The Eocene formation was widely distributed over Europe and Asia, which shows that most of those continents were under the sea even as late as the early Tertiary. The larger part of marine Tertiary rocks are clay beds, soft sand beds, and shell deposits, with occasional limestones, both loose and firm.

In the plants and lower orders of animals that lived in the Tertiary age there were many species that still exist. In North America the forests were much like those of to-day, but had larger quantities of tropical forms. Among fishes, sharks were very plentiful, their teeth being very common in some of the beds. The birds included eagles, cormorants, woodpeckers, and owls; and among the reptiles were crocodiles, lizards, snakes, and turtles.

The first true mammals are found at the opening of the Cenozoic era; the earliest kinds were related to the modern hog and hippopotamus. There were also flesh-eating animals allied to the dog; and through the Tertiary, horses are found.

Mastodons, elephants, camels, and monkeys abounded in the Rocky Mountain region during the Miocene and Pliocene periods.

The lignitic group in the Rocky Mountain region, together with the Cretaceous beneath, had an upturning of the strata which made mountains 3,000 to 4,000 feet high in California, mainly composed of Cretaceous rocks. During the Pliocene, great mountain-making pressure, from the direction of the Pacific, acted with energy against the continental crust, and produced extensive areas of igneous rocks over the Pacific slope and part of the summit region.

The elevation of the Rocky Mountains took place during the Tertiary, and by the close of the age had reached to not less than 11,000 feet; for at this elevation there exist marine deposits of the Cretaceous era. The mode of their formation was the same as that of the Appalachian range previously described; viz., the sinking of the earth's crust, and the accumulations in the trough thus formed of thousands of feet of deposits. Then followed the upturnings, and consolidation, and occasionally a crystallization, of the beds.

The Pyrenees, Apennines, and portions of the Alps were raised thousands of feet during this period, and also in the Miocene era great eruptions of igneous rocks occurred along the coast of England and Scotland. The Giant's Causeway and Fingal's Cave were made in this period.

The North American Continent had then, since early time, been gradually expanding in each direction from the Northern Azoic, and after the Palæozoic age was nearly finished in its rocky foundations. The progress was uniform and systematic from the first, and the enlargement took place with great regularity,

The continents of Europe and Asia also were, during the Tertiary period, increasing in the extent of dry land, and undergoing change in their surface features; and as a rule the continents had at the end of the period their mountains raised to their full height.

The fossil plants indicate that the climate of the United States was, during the early Tertiary, at least warm temperate. It is made evident from the distribution of Tertiary plants that the northern parts of the continents of America, Asia, and Europe were, during that age, under a nearly common forest vegetation, with a comparatively moderate climate; and there is a strong probability that at the close of the period the zones of the earth, as regards temperature, were nearly the same as now.

QUATERNARY AGE, OR ERA OF MAN.

The principal phenomena or striking changes that occurred in the Quaternary period were mainly in the north. At its opening, agencies were at work over the dry land of the continents carrying gravel and earth southward from the northern region. The rivers also were quietly producing results and changing continental levels, until finally the earth assumed its present condition.

The QUATERNARY includes three periods: The GLACIAL or DRIFT; the CHAMPLAIN; and the RECENT or TERRACE.

Ice, either in the form of icebergs or glaciers, was an important factor in the transportation of the bowlders, pebbles, and earth. When in the condition of an iceberg, ice is capable of floating masses of many thousand tons' weight; and glaciers are known to transport bowlders, gravel, and earth. The stones can be traced to the ledges from which they were derived. Bowlders have been traced a distance of four or five hundred miles in Europe, and two or three hundred in North America.

The drift is stratified in the valleys, because the flowing water in which the sands and gravel were deposited spread the material out in beds. On the hills the drift is unstratified.

The scratches on the White Mountains, at a height of 5,500 feet, show that they must have been buried in a great glacier nearly to the summit. The direction in which a glacier moves is in the line of the slope of its upper surface. One to have a southeastward course must have its surface highest to the northwestward, with slope southeastward.

The main cause of the cold of this era is attributed to an elevation and extension of Arctic lands, and to the consequent closing of the Arctic region against the warm current of the Gulf Stream, thus exposing the more southern lands to cold currents of air and water from the Arctic regions.

The Glacial period was followed by one of depression, — the Champlain period, so called from the occurrence of beds of the period near Lake Champlain. It was the era in which the great glaciers, and most of the local, were melted, and in which the deposition of the sand and gravel which they carried occurred.

Facts go to show that the depression in this era increased northward, so that the waters had a slackened flow and a tendency to expand into lakes. All the high alluvial plains, at a level far above the river or lake they border, north of the fortieth parallel, were made in this Champlain period. The subsidence in Great Britain and Europe was in most respects similar to that in America, the depressions below the present level varying in different places from fifty to four huudred feet. At the close of the Champlain period the continent was brought to its present level. The sea-beaches were placed high above the sea, from two hundred feet on the coast of Maine to five hundred near Montreal.

The alluvial flats or flood grounds were made by the rivers, at the time of their floods, wearing away the deposits on either side of their channels.

At the opening of the Recent period, Europe passed through a second glacial epoch, marks of which are found in glacial deposits in the Alps and in Southern France. It is called the *Reindeer Era*, because quantities of the remains of that animal were found in the deposits.

Nearly all the plants and invertebrates of the last part of the Tertiary age are living species, while many mammals are extinct. The culmination of brute mammals was during the warm Champlain period. That the climate and food were all the animals could have desired, the great abundance of their remains testifies. In Great Britain and Europe the caves were haunted by lions, bears, and hyenas; and there were also species of the mammoth or Siberian elephant, the rhinoceros, the hippopotamus, the bear, wolf, elk, deer, etc. The horse resembled the modern animal, though, like all other animals of this period, it was much superior in size.

Similar animals inhabited North America, though it is believed none of them made caves their dens. The *mastodon*, with tusks and trunk like an elephant, though much more gigantic, was the largest of the species. Tapirs, oxen, and beavers were also found, and various species of the sloth. The remains of mastodons are found mostly over the northern half of the United States, also in the Carolinas, Mississippi, and Texas.

The largest of the sloth-like animals was the *Megatherium*, which was larger than the rhinoceros of the present day.

The Australian mammals were the same as now, — generally marsupials, like the kangaroo.

The cold of the second glacial or reindeer epoch became suddenly extreme, as shown by the perfect preservation of the flesh of huge elephants encased in ice.

MAN.

That man was a contemporary of the mammals of the Champlain period, the relics which occur in caverns and river deposits in various regions sufficiently indicate.

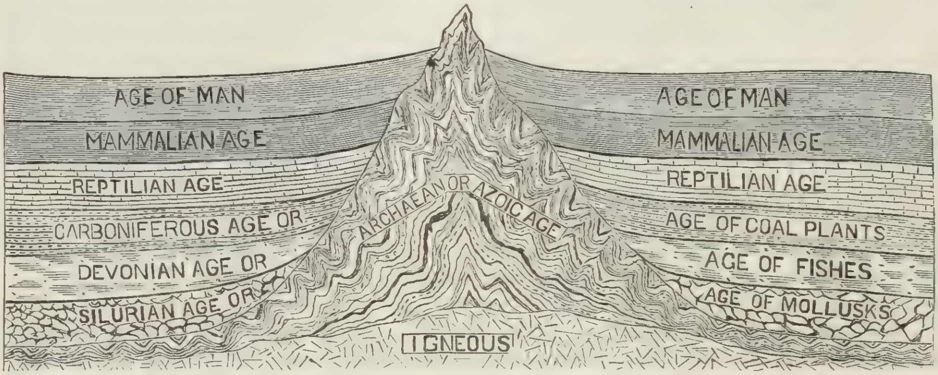


Fig. 15. — The Geological Ages.

The relics by means of which his geological history has been read are stone arrowheads, hatchets, lance heads, and pestles; buried human bones; pottery and carved wood; ivory, bone, horn, or stone cut with figures of existing animals; pieces of charcoal, and other marks of fire for cooking. Such relics occur frequently in what is called the *Stone Age* or

Palæolithic Era in human history. These human relics are so intermingled with those of the cave bear, mammoth, and rhinoceros that there is little reason to doubt that they existed at the same time.

In an era following, the stone implements were frequently polished, and in them are found fragments of pottery and pieces of skeletons of existing quadrupeds. This is called the *Neolithic Era*, from two Greek words signifying "new" and "stone."

The human remains of the Stone Age are those of uncivilized man, but there is nothing to indicate that they were of a race inferior to the lowest of existing races, or which shows any connecting link between man and the ape.

In all the researches of geologists, no human remains have been discovered which can be referred to a higher antiquity than the Quaternary Age.

The progress of life through the ages culminated in the appearance of man. Then it was, also, that the animal structure attained its highest perfection. The vertebrate species which began in the Palæozoic time, and was represented by the prone or horizontal fish, finally became erect in man, and "thus completed," says Agassiz, "the possible changes in the series to its last term." The development of the head of the animal has been the end sought in all progress, and man marks its highest possible victory.

Though the animal system is not now working to a higher end, yet rock-making still continues, and other geological work goes on as in times past. The winds and the waters labor as before, and limestones and sandstones are forming as of old.

Wild animals are being gradually exterminated by the march of civilization; so also are plants. Changes of level in the earth's surface are still going on, which, while probably more restricted than in the past ages of progress, are yet the same in kind.

GEOLOGICAL TIME.

As to the length of geological time, no definite idea can be given. That it must have been very long is evident from what has been adduced in the preceding pages. The rocks through which the cañon of Colorado is cut (see cut in Physical Geography) are over 3,000 feet high, and extend for a length of two hundred miles. The horizontal strata are stretched several miles back from the stream to a height of 7,000 feet above the river's bed. The time required for the formation of these rocks, and also for their excavation by slow-acting water, was millions of years.

We have traced the progress made by the earth through the ages, and have seen that the progress in life was similar; that it was by gradual steps from simple to complex. That the progress was one of development according to system has also been made evident. The Protozoan or first animal life appeared; the Radiate, Mollusk, Articulate, and Vertebrate followed; and all the species which came afterwards were formed according to some one of these systems. As new species were developed in the progress of time, each system displayed itself in higher and more varied forms, till finally it culminated in man. That any species developed into any different species we have no evidence, but that there was a culminating period to each has been satisfactorily established; after which there was a gradual passing away as new and higher tribes were introduced.

The development and progress in the earth that we have been tracing necessarily implies that it had a beginning, and we have reason to believe from analogy that the universe had a beginning. But it can also be demonstrated that the earth will have its end. A state of completion is always the state before decline and extinction. It is on the heat and light of the sun that the earth depends for the existence of its life. The sun is gradually losing its heat, and must ultimately become cool and dark, prior to which the earth will necessarily be dark and lifeless.

MINERALOGY.

MINERALOGY describes the kinds of mineral matter which form the surface of the earth, makes their uses known to us, explains their modes of occurrence in the earth, and indicates the methods of distinguishing them. Much careful attention is required to make progress in the study of the science, inasmuch as a large proportion of the mineral species are of no particular value, and occur in such various forms and colors that it is sometimes difficult to be able to distinguish the useless. Upon the materials which the rocks afford, depends the existence of many of the arts of civilized life. In addition to the metallic ores and metals, we find in them the ingredients for medicinal preparations and for most of our common paints. From them also comes our solid building material, and finally the soil which yields us the necessaries of life. The science has a further charm for the student who is anxious to investigate the principles which give to lifeless matter an organization which, however simple, is yet as perfect as that with which animated beings are endowed.

Many rocks are composed of several minerals closely united. It is the province of mineralogy to distinguish the species, and to enable us to point out the ingredients which make up such formations. It ascertains the qualities of pure specimens, and thus enables us to recognize them in whatever combinations they may occur.

Dana defines a mineral to be "*any substance in nature, not organized by vitality, which has a homogeneous structure.*" That is to say, a mineral is not the product of any process carried on by the agent we call life; neither is a mineral a rock, because a rock is an aggregation of particles. A rock may be of very different compositions, and therefore cannot be said to have a homogeneous structure or structure of a uniform nature.

When minerals are *crystalline*, they may be determined generally by their geometrical shape; when not crystalline, the most conspicuous of them may be known by those physical properties which require no other knowledge than how to observe.

There are various physical characters to be observed in the study of minerals. The way in which their particles are placed together causes them to have several characters.

For instance, a mineral is said to be *brittle* when it breaks easily; *sectile*, when by means of a knife thin slices will separate from the mass, as selenite; *malleable*, when it will flatten out under the hammer like native gold; *flexible*, when it will bend and remain in that position, as asbestos and many of the fibrous minerals; *elastic*, when the mineral returns to its original shape after having been bent, as mica.

Fracture depends on the aggregation of the particles, and is either *conchoidal*, *even*, *uneven*, or *hackly*. It is conchoidal when the surface of the fracture is rendered uneven by concavities and convexities. This fracture is well exhibited if a lump of flint be split.

Some minerals are *fibrous*, as asbestos; some are *crystalline*, as certain marbles which possess a glistening surface like loaf-sugar.

Only a mineral which is soluble in the saliva can affect the *taste*. The taste of common salt is expressed by the term *saline;* that of soda, by *alkaline;* and that of alum, by *astringent.*

Most minerals are inodorous, except when so heated as to give off vapors. Under such treatment some of the arsenic ores produce a smell of garlic, and sulphur gives off the odor of sulphurous acid gas.

There are five characters of minerals dependent upon light; viz., COLOR, LUSTRE, DIAPHANEITY, REFRACTION, and FLUORESCENCE.

LUSTRE is either *metallic*, *pearly*, *vitreous*, *resinous*, *silky*, or *adamantine.* That peculiar lustre which distinguishes the metals is called *metallic.* It is not peculiar to them, however, for graphite (which is carbon) and scales of iodine both possess metallic lustre.

Pearly is that silky and often colored lustre which renders of such value the substance with which mollusks line their shells.

A lump of broken glass possesses what is called *vitreous* lustre. Many minerals also share it, as quartz, calc spar, etc.

Resinous is the lustre which distinguishes the yellow resins, and is also exhibited by zinc blende, opal, etc.

Silky lustre is exhibited by fibrous carbonate of lime, fibrous gypsum, and always by minerals which possess a pearly lustre, when they become fibrous.

The lustre exhibited by the diamond and other highly refractive gems is termed *adamantine.*

The property which all bodies possess, in a greater or less degree, of allowing light to pass through them, is called DIAPHANEITY. There are five degrees of diaphaneity: —

1. *Transparent*, when objects can be distinctly seen through the mineral, as crystals of quartz and carbonate of lime.
2. *Semi-transparent*, when the object is seen, but not clearly.
3. *Translucent*, when light passes, but not so as to define objects.
4. *Translucent on the edges*, when light passes through the edges of the mineral, while the thicker parts are opaque.
5. *Opaque*, when no light passes.

Light, in traversing minerals, does not always obey the ordinary laws of REFRACTION, but sometimes has each ray divided into two. This is termed *double refraction.*

If the greatest solid angles of a rhomb of spar were cut off and the new faces polished, we should find that a ray passing through the crystal in that direction would not be divided. This line is called the *optic axis*, or the *axis of double refraction.* All crystals having unequal axes of symmetry possess this property, while one system in which the axes are all equal does not possess it. Some crystals have two directions in which the ray is not divided, so that in the six systems of crystallization the *tessular* has no double refraction; the *dimetric* and *hexagonal* have one optic axis; and the *trimetric*, *monoclinic*, and *triclinic* have two optic axes.

That property which some minerals possess of retaining the light of the sun for some time after they have been in a dark place is called FLUORESCENCE, a quality possessed by fluor spar.

A table of the relative hardness of minerals is useful in determining the various kinds. That mineral which will scratch another is the harder of the two. (See Physics for table of hardness of minerals.)

The heaviest of known minerals is the ore of iridium, its specific gravity being 19.5; while the lightest is mineral tallow or hatchetine.

CRYSTALLOGRAPHY.

The regular forms assumed by minerals are called *crystals*, and the process by which they assume those forms is called *crystallization*. A liquid on becoming solid is generally a mass of crystalline grains, as exemplified in a loaf of white sugar.

If the particles of a mineral be caused to separate, and afterward permitted to solidify, it will be found that the force of cohesion does not act equally in every direction, but that in most cases it constructs regular geometrical solids or crystals.

If boiling water be added to common salt or alum till all becomes dissolved, and a bunch of threads be suspended in the solution and allowed to remain all night, it will be found in the morning that the string is covered with crystals, the common salt assuming the form of cubes and the alum that of four-sided pyramids.

Sulphur when melted will crystallize on cooling; and the changing of vapors into snow in winter is only a process of crystallization, for every flake of snow is a conglomeration of crystals.

Crystallization and *solidification* are synonymous, and crystallography is the science of solidification in general.

In the hardening of steel, if an increased coarseness of structure be noticed, it indicates that some of the crystalline grains were enlarged at the expense of others.

Gems of the "first water" are small, and perfect crystals generally of moderate size. As they increase in size they become opaque, and the faces lose much of their smoothness and lustre.

Crystals of the same mineral may vary in size and number of faces, but the faces are always equally inclined, that is, the angles of inclination never vary; and *in many cases we have only to measure an angle to determine the species.* It is this constancy of crystalline forms that makes crystallography of so much importance to the mineralogist.

The forms which crystallized minerals assume, vary. Calc spar presents a great variety of forms, yet all its crystals are derived from the same fundamental form.

Fundamental forms are those from which the other forms of crystals are derived.

The *faces* of a crystal are the plane surfaces that bound it; the line where two faces intersect is an *edge*, and the angle which is thus formed is a *plane angle*. A *solid angle* is one formed by three or more faces meeting in a point.

Secondary forms are produced from fundamental forms by replacing the edges. There are thirteen fundamental forms, which are either *prisms*, *octahedrons*, or *dodecahedrons*.

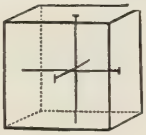
A column having from three to any number of sides is called a *prism*. Its sides are called *lateral planes*, or faces, and its ends are its *bases*. (See Geometry.)

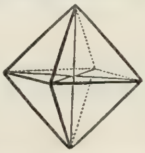
An *octahedron* has eight sides, and a *dodecahedron* twelve.

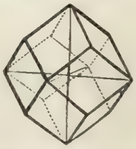
The *axes* of a solid are imaginary straight lines passing through its centre, and connecting the centres of opposite faces, opposite edges, or opposite angles.

The thirteen fundamental forms of crystals constitute, by the arrangement of the axes of symmetry, six systems of crystallization: —

1. The *Monometric*, *Tessular*, or *Cubic system* includes the *cube*, the *regular octahedron*, and the *rhombic dodecahedron*. This system has three axes, all equal, and all at right angles

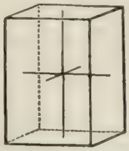

Cube.

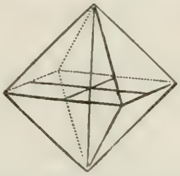

Regular Octahedron.


Rhombic Dodecahedron.

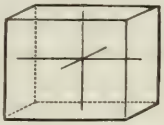
to each other. In the cube the centres of opposite faces are connected by the axes; and in the octahedron and dodecahedron the apices of the solid angles are thus connected.

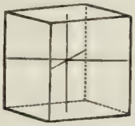
2. The *Dimetric* or *Pyramidal system* includes the *right square prism* and *square octahedron.* This system has three axes, all at right angles to each other, but one axis is longer than either of the other two.

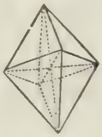

Right Square Prism.


Square Octahedron.

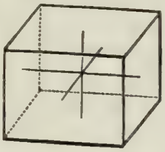
3. The *Trimetric* or *Prismatic system* includes the *rectangular prism*, the *rhombic prism*, and the *rhombic octahedron.* This system has three axes, all unequal and all at right angles. Topaz, nitre, sulphur, and stilbite belong to this system.

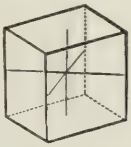

Rectangular Prism.


Rhombic Prism.

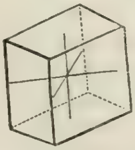

Rhombic Octahedron.

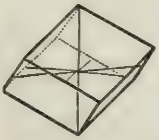
4. The *Monoclinic* or *Oblique system* includes the *right rhomboidal prism* and the *oblique rhombic prism.* The axes of this system are of unequal length, and two of them cut each other obliquely. Borax, sulphate of soda, and phosphate of soda belong to this system.

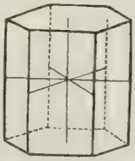

Right Rhomboidal Prism.


Oblique Rhombic Prism.

5. The *Triclinic* or *Doubly Oblique system* consists of the *oblique rhomboidal prism* (and modifications of it), which has three unequal axes, none of which intersect at right angles. Labradorite and blue vitriol are in this system.


Oblique Rhomboidal Prism.


Rhombohedron.


Hexagonal Prism.

6. The *Hexagonal system* includes the *rhombohedron* and *hexagonal prism.* It has four axes, three of which are equal and intersect at angles of 60°; the fourth is perpendicular to

the other three, and varies in length. This system is shown in snow crystals, tourmaline, and nitrate of soda; also in the crystals of quartz.

The property which some crystals possess of splitting into natural layers is called *cleavage.* Galena, the ore of lead, gives cubes by cleavage, and calc spar gives six-sided figures.

Cleavage is uniform in all varieties of the same mineral, and is parallel to the faces of a fundamental form or along the diagonals: and when parallel to similar faces, it is always the same in character; when parallel to dissimilar planes, it is dissimilar.

Secondary forms are modifications of fundamental forms by the *replacement* of the edges or vertices of angles of the latter. An edge or angle is said to be *replaced* when it is cut off by one or more secondary planes. All the similar parts of a crystal are modified similarly and at the same time. Thus, if one edge of a cube, octahedron, or dodecahedron is replaced, all the other edges will be replaced, and by the same planes; so that if there are two planes on one edge, there will be two on every other edge, and the two on each will be similarly inclined.

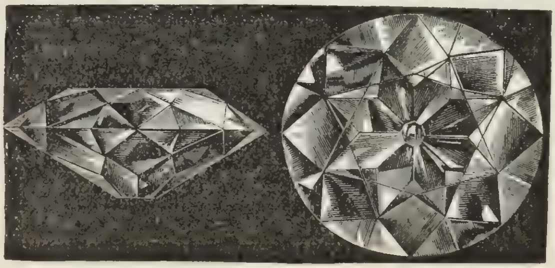
It is usual when treating of the classification of minerals to take up the gaseous and watery compounds first; but as they, together with the sulphates and haloid minerals, are sufficiently described in the articles on chemistry, we shall proceed at once to the consideration of the *carbons.*

THE CARBONS.

CARBON, in a more or less pure state and in a massive form, makes up the different kinds of *mineral coal.* It is found native in three distinct conditions: in the DIAMOND, in GRAPHITE, and in ANTHRACITE.

The DIAMOND crystallizes in the monometric system, generally in octahedrons and dodecahedrons, and has faces very often curved. The cleavage of the diamond is perfectly octahedral; its hardness 10, specific gravity 3.48–3.55, lustre adamantine; it is usually colorless or white, but sometimes yellowish, red, orange, green, brown, or black. It is almost pure carbon, and when heated to a high temperature burns into carbonic-acid gas. It is believed that the diamond was formed in sandstone rocks, called *itacolumite,* and that it is of vegetable origin. It is now generally obtained from alluvial washings in South Africa, in Brazil, in the Ural Mountains, and near Delhi and Golconda; and occasionally in North Carolina and Georgia. It usually appears like a broken lump of glass with a lustrous glitter.

Diamonds are sold by weight; the unit employed is a *carat,* which is about three and one sixth grains troy. The term "carat" is derived from the name of a bean used in Africa to weigh gold. The value of a diamond is determined by doubling the weight in carats and multiplying the square of the product by £2. Thus a cut diamond weighing one carat would be worth £8, one weighing ten carats £800.



The Koh-i-noor.

The largest diamond on record belonged to the Great Mogul, and weighed originally 900 carats, but in cutting was reduced to 272½ carats. The celebrated Koh-i-noor, now in the possession of the Queen of England, weighed originally 793 carats, but by repeated cuttings has been reduced to its present weight of 103¾ carats.

Diamonds are used for cutting glass, on the point of drills for cutting stones, and for microscope lenses. Those that are useless for working thus are called *bort*, and are used for drilling other gems and piercing holes in artificial teeth.

Mineral coal is carbon with generally a slight admixture of silica and alumina, and occasionally oxide of iron. When it does not contain any bitumen it is called ANTHRACITE. The specific gravity of anthracite is 1.3 to 1.75, and it generally contains eighty to ninety per cent of carbon and four to seven per cent of water, the remainder being earthy impurities.

Bituminous coal is not so lustrous as anthracite, and is much softer, with a specific gravity not exceeding 1.5.

Cannel coal has little lustre, is very compact, and breaks with a conchoidal — that is, a very uneven or shell-like — fracture. It burns without melting, and pieces have often been used as candles, from which fact it takes its name.

Lignite is a coal of less perfect variety, and often has the structure of the original wood.

Pitching or *caking* coal, principally found at Newcastle, England, breaks into small pieces when heated, and on the heat increasing unites into a solid mass. For method of formation of coal beds, see Geology.

GRAPHITE OR PLUMBAGO, the black-lead of pencils, contains about ninety-six per cent of carbon, and the remainder iron. It belongs to the hexagonal system, being found in six-sided prismatic crystals. It is found in crystalline rocks, particularly in gneiss, mica slate, and granular limestone, and has a metallic lustre, the color varying from iron-black to dark steel-gray. Its hardness varies from 1 to 2, and its specific gravity is 2.09. The principal locality where it is found in England is at Borrowdale, in Cumberland; and in the United States in the Adirondack (N. Y.) region and at Sturbridge, Mass. It is employed extensively in the manufacture of crucibles and furnaces, and in lessening the friction of machinery.

BITUMEN is found in both a solid and fluid state; when fluid it is transparent and almost colorless, and when solid it is either black or of a brown or reddish color. Its principal varieties are *asphaltum*, *petroleum*, and *naphtha*.

Asphaltum is a massive variety, and generally breaks with a lustre like hardened tar. It is found on the shores of the Caspian and Dead Seas, and on the island of Trinadad.

Petroleum is a bituminous fluid which issues from some rocks, and is of a dark color. It is found in many localities in the United States, principally in Pennsylvania, Virginia, and Ohio.

Naphtha is a fluid lighter than water, generally clear or yellowish, whose specific gravity is 0.7 to 0.84. When exposed it changes to petroleum. In Persia and Burmah it often issues from the earth in large quantities, and is used both as fuel and light by the inhabitants. Naphtha is sometimes used in oil paint as a substitute for oil, and possesses properties which make it serviceable as a lotion. This last statement is true also of petroleum.

THE SILICATES.

THE *silicates* are generally six-sided prisms, modified more or less and terminating with six-sided pyramids. *Quartz* is the most important of the silicates. It has no apparent cleavage, but when the crystal is heated and plunged in cold water, cleavage is sometimes obtained. It is composed of pure silica, though opaque varieties of it often contain clay, oxide of iron, or chlorite. The crystals of quartz are frequently as transparent as glass, and are generally colorless, though they occasionally present yellowish or smoky tints. The hardness is 7, and the specific gravity 2.6 to 2.7. The characteristics of quartz are hardness, infusibility, insolubility, and the absence of cleavage.

There are three general varieties of quartz; viz., the VITREOUS, the CHALCEDONIC, and the JASPERY.

The VITREOUS is generally known by its glassy fracture. The vitreous varieties include *rock crystal*, a pure transparent quartz; the *amethyst*, a valuable variety of quartz crystal of a purple or bluish-violet color, and so called from its supposed preservative powers against intoxication; the *rose* quartz, the *false topaz*, *smoky* quartz, *milky* quartz; *prase*, a massive quartz of a leek-green color; and *ferruginous* quartz, which includes opaque, yellow, brownish-yellow, and red crystals. The variety in color is due to oxide of iron.

The CHALCEDONIC varieties include *chalcedony*, which is a massive variety, generally of a pale-gray, blue, or light-brown shade; *chrysoprase*, an apple-green chalcedony; *carnelian*, a chalcedony of a bright-red color; *sard*, a deep brownish-red chalcedony; *agate*, a chalcedony of different colors, which are distributed in concentric lines, or in clouds or spots.

Moss agate is brownish, and consists of chalcedony with moss-like delineations of an opaque yellowish-brown color, caused by the distribution of oxide of iron. If the agate be boiled in oil and dropped into sulphuric acid, its colors may be darkened.

The *onyx* is an agate with the colors in flat horizontal layers. It is the material used for cameos; the figure when carved out of one layer stands in relief on another.

Flint occurs in knots in chalk, and sometimes the knots are in part chalcedonic. Flint is compact silica of dark shades of smoky brown, gray, or black.

Hornstone is more brittle than flint, and is found in limestone.

The JASPERY varieties include jasper, which is a silicious rock of a dull red or yellow color, containing some clay and oxide of iron. There are several kinds of jasper; viz., *ribbon*, *Egyptian*, *ruin*, and *porcelain* jasper. The latter is simply a baked clay, and differs from jasper in being fusible.

Bloodstone or *heliotrope* is a stone of a deep-green color, containing red spots resembling drops of blood. In addition to silica, it contains a small proportion of clay and oxide of iron.

Lydianstone or *touchstone* is a flinty jasper which, from its hardness and black color, is used for trying the purity of the precious metals.

Silicified or *petrified wood* generally consists of quartz. When petrified with agate or chalcedony, some specimens retain the grain of the original wood.

The *opal* is a compact mineral which exhibits a pleasing variety of colors when turned in the hand. It is of a subvitreous lustre, with a specific gravity of 2.21. Its hardness is 5.5 to 6.5. The opal is made up of soluble silica and five to twelve per cent of water. Of the many varieties of this mineral, the principal is the precious opal. It is generally of a milky color externally, with a rich play of delicate tints within, and is considered a gem of rare beauty.

LIME.

THE salts of lime are inodorous, and none of them are soluble except the nitrate of lime, unless in very minute proportions.

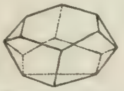
GYPSUM is sulphate of lime. It belongs to the monoclinic system, and generally appears in tabular forms. It cleaves easily, allowing very fine laminæ — which are flexible, but not elastic — to be separated. It is very soft, being easily cut with a knife. When massive it is sometimes found fibrous, with a satin lustre. Its specific gravity is 2.31 to 2.33, and its hardness 1.5 to 2. Gypsum is composed of sulphuric acid 46.5, lime 32.6, and water 20.9. It has no action with acids, and fuses with difficulty at a high heat. When found crystallized and transparent, it is called *selenite*.

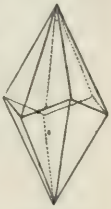
When gypsum is dried, after being ground into a powder and mixed with water, it is called *plaster of Paris*, and is used for making models, taking casts, finishing walls, etc.

CALCITE, OR CARBONATE OF LIME, sometimes called **CALCAREOUS SPAR**, consists of 56 parts lime and 44 parts carbonic acid.

Calcareous spar, when it appears in a crystalline form, is a rhombohedron; hence it belongs to the hexagonal system. When in massive varieties it is usually opaque and without lustre, but when in pure crystal it is transparent and has a vitreous lustre. Its specific gravity is 2.5 to 2.8, and its hardness is 3. The massive varieties vary from white to black, while the crystals are generally white, with occasionally grayish or yellowish tints. It effervesces with the acids, and when heated many varieties of it phosphoresce, or emit light without heat. When crystallized, and the crystals are transparent, it is called *Iceland spar*, which possesses in a large degree the property of double refraction.

One of the varieties of calc spar is called *nail-head spar*, on account of its crystalline form; and another, for a similar reason, is called *dog-tooth spar*.


Crystal of Nail-Head Spar.


Crystal of Dog-Tooth Spar.

Chalk is without lustre, being white and earthy and soft.

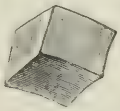
Stalactite is the carbonate of lime which hangs from the roofs of caverns. When the deposits cover the floor of a cavern they are called *stalagmites*.

Limestone is a general name for all the massive varieties which occur in extensive beds; and where the grains are crystalline it is called *granular limestone*, the coarser varieties of which, when polished, constitute the common building marbles, while the finer are used for statuary. The secondary limestones without grains, which break with a smooth surface, are called *compact* limestones. They are colored sometimes of a uniform tint, and sometimes in bands or veinings.

When any of the varieties of limestone are burnt, *quicklime* is formed. The carbonic acid is driven off by the heat, and the lime is left in a pure state.

Hydraulic lime is procured from limestones which contain a portion of clay, and from it a cement is made which becomes solid under water.

DOLOMITE, or MAGNESIAN LIMESTONE, presents faces rhombohedral in form, which are sometimes curved. It is often massive and granular, and has a cleavage which is perfect and parallel to the primary faces. Its specific gravity is 2.8 to 2.9, and its hardness is 3.5 to 4. It has a vitreous lustre, and the color is generally white or tinged with green, red, yellow, or brown, and occasionally with black.


Crystal of Dolomite.

Dolomite is composed of 54.4 per cent of carbonate of lime and 45.6 per cent of carbonate of magnesia, and it will effervesce when in contact with acids. It is used in the manufacture of *Epsom salts*, and when burned to quicklime it makes a strong cement.

APATITE is phosphate of lime. When found crystallized, it is in short hexagonal prisms of a greenish color. It is composed of phosphate of lime 92.1, fluoride of calcium 7, chloride of calcium 0.9, and will dissolve slowly in nitric acid. Apatite is distinguished by being easily scratched with a knife, by its difficult fusibility, and by its phosphorescence. It is found in most metamorphic rocks and some granites.

FLUOR SPAR is fluoride of lime. It crystallizes in cubes, and its cleavage is perfectly octahedral. It is generally of a bright color, and seldom occurs fibrous. Its specific gravity is 3.14 to 3.18, and its hardness is 4.

Fluor spar is composed of fluorine 48.7 per cent and calcium 51.3 per cent. When ground to a powder and moistened with sulphuric acid, it gives off a gas which corrodes glass; and when placed on a hot iron it phosphoresces, giving a bright light of different colors. The variety that affords a green phosphorescence is called *chlorophane.*

The bright colors of fluor spar give it the appearance of some of the gems, but it is readily distinguished by its softness and by its strong phosphorescence.

Fluor spar in its massive form takes a high polish, and in England is made into vases, candlesticks, etc. It is also used for obtaining fluoric acid, which is employed in etching. Whatever design it is desired to etch is first traced in a thin coating of beeswax and turpentine resin melted together, with which the glass is first covered. When the fluoric acid has been washed over it and the wax removed, the picture is found to be engraved on the glass. Any silicious stone may be acted on in the same manner.

Fluor spar is sometimes used as a flux in reducing copper and other ores.

THE MAGNESITES.

TALC, when crystallized,—which is rare,—appears in rhombic or hexagonal prisms. Generally, however, it is massive, composed of minute pearly scales. It is eminently foliaceous or leafy, the laminæ or scales being flexible, but not elastic. The color is occasionally white, but usually has a greenish tint. It is very soft, being easily scratched with the nail, and possesses an oily feel. Its specific gravity is 2.5 to 2.9, and its hardness 1 to 1.5.

Soapstone or *steatite* is a talc which owes its name to its soapy feel. It is generally white, sometimes a little greenish or yellow. Foliated talc is composed of silica 62.8, magnesia 33.5, water 3.7. A small portion of magnesium is frequently replaced by iron. Steatite is composed of silica 62, magnesia 30.5, protoxide of iron 2.5, water 5. Talc fuses with great difficulty, and loses its color before the blow-pipe.

The principal characteristics of talc are its leafy structure, its soapy feel, and its pearly lustre. Soapstone is used for jambs for fireplaces, and for fire-stones in furnaces and stoves. It can be sawed and turned in a lathe, and is occasionally used in the manufacture of porcelain, and as a polishing material for glass, serpentine, and alabaster.

CHLORITE is of a pearly lustre, and is always green. It usually appears in dark olive-green masses; but when crystallized it is found in hexagonal crystals, foliated like mica, —with which it may easily be confounded,—but the laminæ are not elastic.

SERPENTINE is generally massive and compact in texture. Its ordinary color is a mottled green, and its cleavage indistinct. It is of weak lustre, and sometimes feels a little soapy. Its specific gravity is 2.5 to 2.6, and hardness 2.5 to 4.

Precious serpentine, the most important of the varieties of this mineral, is a beautiful stone when polished. It is composed of silica 42.3, magnesia 44.2, protoxide of iron 0.2, carbonic acid 0.9, water 12.4. When heated it gives off water, and fuses only on the edges. Common serpentine is of a dark-green color and opaque.

Serpentine when polished is a handsome marble, and where mixed with limestone is called *verd-antique.* The variety of its shades is often increased by chromic iron, which is generally mixed through it. Sulphate of magnesia may be made from it.

MEERSCHAUM, *Sea-Froth*, or *Sea-Foam*, is a talc composed of silica 60.8, magnesia 27.1, water 12, oxide of iron and alumina 0.1. When first taken from the earth it is soft, and will make a lather with water. The Tartars use it for washing their linen. When heated it gives off water with a fetid odor, becoming a white hard body. Its chief use is to make the bowls of pipes. The specific gravity of meerschaum is 2.6 to 3.4, and its hardness is 1.

Schiller-Spar crystallizes in the triclinic system. It is of an olive and blackish-green color, with a metallic pearly lustre on a cleavage face; in other directions it is vitreous. It generally occurs massive, and has cleavage in two directions, which give a thin-foliated structure. Its specific gravity is 2.5 to 2.7, and hardness 3.5 to 4. It fuses only on the thinnest edges, and gives off water when heated. The composition of Schiller-spar is: Silica 43.9, magnesia 25.9, oxide of iron and chromium 13, water 12.8, alumina 1.3, lime 2.6, protoxide of manganese 0.5.

It is liable to be confounded with *diallage*, which also occurs in serpentine, but may be distinguished from it by its yielding water before the blow pipe. Schiller-spar is found embedded in serpentine.

Pyroxene crystallizes in the monoclinic system. It is in oblique rhombic prisms, and has cleavage parallel with the sides of the prisms, and also parallel with the diagonals. It is of various shades of green, and has a vitreous lustre. Specific gravity 3.2 to 3.5, hardness 5 to 6. It is composed of silica and magnesia in combination with one or more of the bases lime, protoxide of iron, or protoxide of manganese. These bases replace one another in a compound without changing the crystalline form.

The varieties of pyroxene generally are divided into light-colored, dark-colored, and thin-foliated.

White augite or *white malacolite* is made up of white or grayish-white crystals, and appears in several varieties, the specific gravity of which varies from 3.25 to 3.3.

White augite when mixed with borax or soda will form a transparent glass. It is composed of silica 55, lime 23.5, magnesia 16.5, protoxide of manganese .5, and protoxide of iron 4.5.

Asbestos includes both pyroxene and hornblende in fibrous varieties. Its fibres are easily separable. Usually it is white, occasionally green. It is noted for its resistance to fire, and is used in gas stoves for the flames to play against. The asbestos, becoming red-hot, assumes the appearance of live coal. It may be woven into a fabric, which is sometimes used as a covering where fire is to be resisted.

Augite consists of two atoms of silica combined with three of magnesia, lime, or iron protoxide. Its specific gravity is 3.3 to 3.4, and its principal varieties are hedenbergite, polylite, hudsonite, and jeffersonite.

Diallage occurs embedded in serpentine, and is of a clear green variety, with a thin-foliated structure.

Pyroxene occurs in basalt and lavas, also in granite, granular limestone, and serpentine. The crystals in basalt and lavas are generally small and black; in other rocks they are of all shades, and vary in size from an inch to a foot or more in length.

Hornblende occurs in oblique rhombic prisms more or less modified; hence it belongs to the monoclinic system. It cleaves perfectly in places parallel with the faces of the prisms. It is also found fibrous, coarse or fine, with a silky lustre. It varies greatly in color, passing from white through green to black, according to the quantity of iron it contains. The specific gravity of hornblende is 2.9 to 3.4, and its hardness 5 to 6.

Typical hornblende may be regarded as a compound of three atoms of silica with four atoms of magnesia, lime, or protoxide of iron; alterations in these latter constituents producing the varieties.

Tremolite is a light-colored variety of hornblende, generally consisting of long white crystals penetrating metamorphic rocks, especially the dolomite of Val Tremola in Switzerland. Its specific gravity is 2.93.

Actinolite appears in the same way, but is light green. When a quantity agglomerates a radiated structure results, and the color darkens. It contains from six to eight per cent of the peroxide of iron, and its specific gravity is 3.02. Hornblende is an essential constituent of syenite, trap, and hornblende slate.

ALUMINA.

CORUNDUM occurs usually in six-sided prisms, though occasionally it is granular. Its colors range from blue to nearly black. It is composed of pure alumina, and has a specific gravity of 3.9 to 4.16; and its hardness is 9, ranking next to the diamond.

Of the varieties, when the crystals are clear and of bright colors, they are called *sapphires;* and if granular, and of a bluish or blackish color, they are called *emery.*

The true color of the sapphire is blue. When red, it is called the Oriental ruby; when yellow, the Oriental topaz; when green, the Oriental emerald; when violet, the Oriental amethyst; and when hair-brown, the adamantine spar. The distinguishing characteristic of corundum is its hardness.

The *sapphire* is generally found loose in the soil, in mica slate and granular limestone. It is seldom found in the United States sufficiently fine for a gem, though blue crystals several inches long have been found at Newton, N. J.

The red sapphire is the one most highly esteemed, some specimens equalling in value diamonds of the same size. In Mr. Hope's collection of precious stones there is a crystal for which he gave £3,000 sterling. The largest Oriental ruby known is now a jewel in the imperial crown of Russia, and was originally brought from China.

SPINEL is mainly composed of alumina and magnesia. It is an octahedron of the monometric system, with difficult cleavage; the color, red with occasional dark shades. The species is distinguished by its hardness and the form of the crystals. *Garnet* is fusible; *zircon* is not so hard, but has a high specific gravity.

Spinel occurs in gneiss and volcanic rocks, also in granular limestone. The red spinel is the common *ruby* of jewelry.

ORTHOCLASE OR COMMON FELDSPAR is composed of silica, alumina, and potash. It is light-colored, white, gray, or flesh-colored, and may occasionally exhibit a greenish tint. It occurs in the monoclinic system, and has a vitreous lustre; its hardness is 6, and its specific gravity 2.39 to 2.62. It can be fused before the blow-pipe on its edges, but with borax it forms a transparent glass. It defies the action of acids.

Adularia is a white variety found on Mount Adula, the highest peak of the St. Gothard. When opalescent and exhibiting peculiar pearly reflections, it is *moonstone.*

Feldspar is distinguished from scapolite by a tendency to a fibrous appearance and by its more difficult fusibility. It occurs frequently in crystals in basalt, granite, gneiss, and mica slate, and is used largely in the manufacture of porcelain.

KAOLIN is clay derived from the decomposition of feldspar, — a decomposition which is effected by the replacing of the alkali (potash), and a little of the silica with water. This clay is found in beds in granite districts, and is much used in the manufacture of porcelain.

ALBITE has the same composition as orthoclase, save that soda takes the place of the potash. It is very similar in every respect to that mineral. Its crystals are more oblique, being of the triclinic system; and when placed in the blow-pipe flame it tinges the flame yellow. Its color is whiter than orthoclase; hence its name, *albus*, white. Its specific gravity is 2.6 to 2.7, and its hardness 6.

LABRADORITE contains more lime than any of the preceding feldspars. It is composed mainly of silica and alumina, and is generally dark colored. It frequently offers a play of many colors, and there are occasionally white specimens. It is sometimes used in jewelry, admitting of a high polish and affording reflections of rich and delicate colors. It does not occur in granite, but is occasionally found in gneiss.

The prevailing color of the GARNET is deep red, though it is also brown, black, green, and white. It has a vitreous lustre, and is very brittle. Its specific gravity is 3.5 to 4.3, and hardness 6.5 to 7.5.

The garnet occurs in dodecahedrons and trapezohedrons, in the former of which it has distinct cleavage parallel to the faces. It is composed of the silicates of alumina, lime, iron, and manganese.

The precious garnet or *almandine* is of a clear, deep red, and is much used in jewelry. Common garnet is of a brownish-red color, and is generally opaque.

Cinnamon-stone or *essonite* has a high lustre, and is of a light cinnamon-yellow color. *Topazolite* is a yellow variety, and resembles topaz in color.

Garnet is readily distinguished by its dodecahedral forms, and by its vitreous lustre when fractured, without any traces of prismatic structure. It generally occurs in mica slate and gneiss, also in hornblende slate and granular limestone, and occasionally in serpentine and lava.

The most precious garnets are from Greenland and Ceylon, and the cinnamon-stone is found in Sweden and Ceylon. Small-sized precious garnets are found in parts of New Hampshire and Pennsylvania. The deep-red garnets and cinnamon-stones are used as gems, and when pulverized are sometimes employed as a substitute for emery.

TOURMALINE is frequently found in prisms penetrating granite, gneiss, mica slate, granular limestone, and other metamorphic rocks. Its color passes through nearly all shades. The crystals are very brittle, and exhibit a vitreous lustre. It belongs to the hexagonal system, and its prisms, which usually exhibit numerous secondary faces, are generally terminated by a low pyramid. It becomes electrically excited when heated, and is the mineral always used to exhibit pyro-electricity. Specific gravity 3 to 3.1, and hardness 7.8.

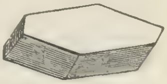
The black variety is made up of silica, alumina, lime, protoxide of iron, soda, and boracic acid. Lithia is sometimes present in the red variety, but the most remarkable point in its make-up is the presence of *boracic acid*. The red, green, and yellow varieties of tourmaline are distinguished from any species they resemble by the prism always having three sides or some multiple of three. The dark and black varieties are known by their difficult fusibility and the absence of distinct cleavage.

The red and yellow tourmalines make gems of great beauty. The former are found at Paris, Me., and the latter come principally from Ceylon. The thin crystals found at Grafton, N. H., can be used in polarizing instruments.

MICA.—MUSCOVITE or white mica occurs in plates, which may be regarded as short rhombic prisms of the trimetric system. It can be divided into thin elastic laminæ of great thinness. Its colors run from white through green, yellowish, and brownish shades to black. Specific gravity 2.8 to 3, and hardness 2 to 2.5. It is composed of silica 46.3, alumina 36.8, potash 9.2, peroxide of iron 4.5, fluoric acid 0.7, and water 2.5.

The color of black mica is owing to the presence of iron, which is associated with magnesia.

Mica differs from talc in being elastic and having thinner leaves, and also in not having the soapy feel of that mineral. It occurs in granite, gneiss, and mica slate, also in granular limestone. Windows for lanterns


Crystal of Mica.

and doors for stoves are made from it, and it is used also for preserving minute objects for the microscope. It is abundant in New Hampshire in forms useful for the arts.

Topaz is trimetric, and occurs in right rhombic prisms having a perfect basal cleavage. It is composed of silica, alumina, and fluorine, and is of a yellow color. Topaz can be readily distinguished from the minerals which it resembles by its transverse cleavage. It generally occurs in granite, associated with tourmaline and beryl. The transparent varieties are used in jewelry, while the coarse, opaque forms are sometimes substituted for emery in polishing hard substances.

Lapis-lazuli (ultramarine) is monometric, occurs in dodecahedrons, has a rich azure blue color and a vitreous lustre. Its hardness is 5.5; specific gravity, 2.3–2.5. The finest specimens are found in Persia, China, and Siberia, and are much used for inlaid work of ornamental furniture and vases, also for mosaics.

Until the recent discovery of a way to produce *ultramarine* chemically, this mineral was used in powdered form for ultramarine paint, and was one of the most costly colors.

The artificial ultramarine consists of silica 45.6, alumina 23.3, soda 21.5, potash 1.7, sulphuric acid 3.8, sulphur 1.7, iron 1.1, and lime and chlorine in such small quantities that the respective amounts are not determined.

GLUCINA.

Beryl is the head of a small family, the members of which all contain glucina. It is found in hexagonal prisms in granite and metamorphic rocks, and has a waxy appearance and pale-green color. The beryl of the Mourne Mountains, in Ireland, tends toward a cerulean or sky blue. It is composed of silica 66.9, alumina 19, and glucina 14.1.

When beryl is transparent and but slightly tinted with green, it is known as *aquamarine.* The largest known specimen is in the possession of Dom Pedro, and was found in Brazil; it weighs 18½ pounds troy, and is without a flaw.

Beryls of great size have been obtained in the United States, though but few transparent crystals among them.

The *emerald* is of a rich green color, due to oxide of chrome. The best emeralds come from Granada, S. A., where they are found in dolomite. This gem is much prized in jewelry. All the members of the beryl family are harder than quartz.

Euclase is found in oblique rhombic prisms, with perfect cleavage in one direction, being thus distinguished from tourmaline and beryl. Its color is pale-green, and lustre vitreous. Before the blowpipe it fuses to a white enamel. The crystals are fine gems, but are seldom cut for jewelry on account of their brittleness.

ZIRCONIA.

Zircon occurs in dimetric prisms and octahedrons, and is usually found in single crystals scattered in beds of basaltic lava or syenite. Its color is red, shading off into neighboring tints or yellow, tending toward gray. When the red specimens are transparent they are called *hyacinths.* The specific gravity is 4, and hardness 7.5.

The *hyacinth* can be distinguished from spinel by its specific gravity and prismatic form, while from other minerals which it resembles it may be known by its hardness and infusibility. It is found in Ceylon, Bohemia, and Greenland. Zircon is used in jewelling watches, and when heated in a crucible with lime it loses its color.

METALLURGY.

METALS are found either native or mineralized. They are said to be *native* when they are either pure or in *alloy* with other metals, and *mineralized* when they are in *combination* with other substances. Any metal chemically combined with some mineralizing substance which completely disguises its usually recognized and useful properties is an *ore*. The most common of these mineralizing substances are oxygen, sulphur, arsenic, carbonic acid, and silica. For instance, the common workable iron ores are compounds of the oxides and carbonate of iron.

The principal metals which are found native are gold, platinum, iridium, palladium, and rhodium. Native silver, copper, and mercury are abundant in some localities, but the quantities thus found form but a small proportion of the main sources of these metals. Native iron is composed of large meteoric masses, and is seldom if ever seen of terrestrial origin. Ores are often so mixed together, or with earthy material, that the difficulty of separation and reduction renders them comparatively useless. The ores of lead and zinc, iron and manganese, and several others, are often found closely associated throughout the rock.

Metals and their ores may occur in rocks, either scattered through them in grains, crystals, or masses, as is the case with argillaceous iron and mercury ore; or in beds between layers of rock, as in some of the iron ores; or in veins crossing different rocks, as in most of the metallic ores, such as copper, tin, and lead.

The mineral substance which either encloses or accompanies any metallic ore in the vein is called the *gangue*. As a general rule the ore is scattered in detached masses through the gangue, but sometimes is in a continuous body for a long distance.

The common kinds of gangue are either quartz, calc spar, or heavy spar, and occasionally fluor spar. The lead ore of the Mississippi Valley is generally found in the heavy-spar gangue, while the Rossie lead ore occurs in the calc-spar gangue.

The reduction of an ore is the operation of separating a metal from the substance or substances with which it is combined; and in order to do this it is necessary to separate the gangue and the impurities or minerals mixed with the ore, also the ingredient with which the ore is compounded. A good part of the gangue will be separated in the act of mining, while another portion may be removed by *washing* or allowing a current of water to pass over the ore when pounded. A fusible metal or ore is separated by heating the pounded ore in crucibles. When the metal is melted, it flows out.

To separate gold, mercury is mixed with the pounded rock after washing, and as it unites with the gold the latter is dissolved out from the gangue, and the gold obtained afterward by evaporating the mercury. Heat alone sometimes effects the separation of the compounds when the ore is pure. For instance, the ores of lead and mercury will, when heated, give up part of their sulphur. Generally, however, some material is added which will combine with and carry off the mineralizing ingredient, as charcoal does with some iron ores.

If there is more than one metal mixed in the ore, one is generally burned out, which process is called *oxidation*. If lead containing silver be heated in a draught of air, an earthy slag will be formed by the lead uniting with the oxygen of the air, while the silver, which is not thus affected, remains. Most of the iron in copper ore is removed by repeated melting and stirring when exposed to a draught of air.

But generally the gangue is mixed, and in that event a material is used which, when heated, will fuse with the gangue and impurities. This material is called a *flux*. Thus common limestone, from its easy fusion into a glass with silica, is generally used as a flux in iron furnaces.

Sometimes the ores are subjected to a process called *roasting*, which is an operation preparatory to that of reduction or smelting, in which the volatile ingredients, or those which easily evaporate (as sulphur and arsenic), are by means of heat expelled, or replaced by oxygen.

IRON. — The most abundant iron ores are the *oxides* and *sulphurets*. It is also found in combination with silica, and carbonic and other acids, as well as with other metals, and is occasionally of meteoric origin. Its ores, which are widely scattered, generally give color to soils and rocks. The maximum specific gravity of iron ores is 8, though in the majority of them it does not exceed 5. Some of them become attractable by the magnet, which were not so previously, after being heated; and quite a number are infusible before the blow-pipe. Those iron ores which have a metallic lustre are distinguished from the ores of silver and copper by their difficult fusibility and by reduction.

NATIVE IRON occurs in the monometric system, in regular octahedrons. It is of an Iron-gray color, and is both malleable and ductile, with cleavage parallel to the faces of the octahedron. Specific gravity 7.3 to 7.8, and hardness 4.5. Native iron, when meteoric, has an alloy of nickel amounting in some cases to nearly twenty per cent, and occasionally contains a small percentage of tin, copper, and manganese.

A mass of meteoric iron, weighing 1,635 pounds, was found in Texas, and is now in the cabinet of Yale College. The presence of nickel in meteoric iron lessens its tendency to rust; and the appearance of a phosphuret of nickel shows that these meteoric bodies when in space have not an atmosphere like ours, inasmuch as no phosphuret occurs in terrestrial minerals on account of the abundance of oxygen.

MAGNETITE belongs to the monometric system, and generally occurs in octahedrons and dodecahedrons. It is of an iron-black color, having a specific gravity of 5 to 5.1, and hardness 5.5 to 6.5, and occasionally has polarity. It is composed of iron 72.4 and oxygen 27.6, and occurs in granite, gneiss, mica slate, hornblende, syenite, and sometimes in limestone.

Nearly all the Swedish iron ore consists of magnetic iron, and in portions of Southern Sweden and Lapland some mountains are composed of it. Vast beds of magnetic iron ore occur in many places in the United States: in New York, Maine, Vermont, and Massachusetts, also in New Jersey, Pennsylvania, and New Hampshire.

LODESTONE is the name given to this ore when in a state of magnetic polarity. It is found near Providence, R. I., at Marshall's Island, Me., and sparingly elsewhere.

METEORIC ore may be separated from its impurities by means of a magnet, and it is superior to any other kind for the manufacture of iron.

SPECULAR IRON ORE, or HEMATITE, is rhombohedral in form, with indistinct cleavage, and occasionally micaceous, though generally massive granular. Specific gravity 4.5 to 5.3, and hardness 5.5 to 6.5. It is of an iron-black or dark steel-gray color, the metallic varieties when pulverized being earthy and of a deep red color.

Red hematite is of a brownish-red color and unmetallic, while *red ochre* often contains clay, and is soft and earthy.

The pure ore is composed of seventy parts of iron and thirty of oxygen, and is infusible before the blow-pipe. Hematite may be distinguished from magnetic iron ore by its red powder, and from copper and silver ores by its infusibility and hardness. It is found in both stratified and crystalline rocks. The clayey varieties occur in stratified rocks, while the pure ore abounds in the primary rocks. This ore is found abundantly in the United States. The two iron mountains of Missouri, one three hundred feet high and the other seven hundred feet, are mainly composed of it. It is also found in Maine, New Hampshire, Massachusetts, New York, and Pennsylvania.

Red hematite when powdered is used for polishing metals, while the red chalk variety is used for red pencils.

Brown Iron Ore, or Limonite, has an interior compact-fibrous structure, and is generally massive. Its specific gravity is 3.6 to 4, and hardness 5 to 5.5, and the color is from dark brown to ochre-yellow. It is composed when pure of peroxide of iron 85.6 and water 14.4, and becomes magnetic and blackens before the blow-pipe. Limonite is softer than hematite or magnetite, and when heated in a glass tube it affords water. It is found abundantly in the United States, in New York, Connecticut, Massachusetts, Vermont, Missouri, Pennsylvania, Wisconsin, Iowa, and Tennessee.

Limonite is a valuable iron ore, and when powdered is used as a polishing material, and under the name of *yellow ochre* as a paint.

Spathic Iron Ore, or Siderite, belongs to the hexagonal system. It is generally massive, with its structure foliated and curving. Specific gravity 3.7 to 3.85, and hardness 3 to 4.5. Its color is light-gray to brown, with lustre pearly to vitreous.

Spathic iron when pure is composed of protoxide of iron 62.1 and carbonic acid 37.9, and occasionally contains some magnesia. It is infusible when alone, and becomes magnetic before the blow-pipe. It effervesces only when powdered, and it dissolves in nitric acid.

This mineral has a higher specific gravity than dolomite and calc spar, but is foliated like them. Before the blow-pipe it becomes magnetic.

The greatest beds of spathic iron occur in gneiss and in the coal formation. It is found at Sterling, Mass., and Plymouth, Vt.; also in Connecticut, New York, and in the coal regions of Pennsylvania. Spathic iron is largely used for the manufacture of iron and steel.

The ores from which the iron of commerce is obtained are magnetic iron, spathic iron, specular iron, hematite or brown iron ore, and bog iron ore. All these different ores are worked in the United States.

In the assay of ores in the dry way, different means are used for the different ores, for economical purposes. The object is the same as in the reduction in the large way; viz., the separation of the iron from the oxygen with which it is united, and from whatever impurities it may contain.

A simple mixture of the powdered ore and charcoal, strongly heated in a crucible, is all that is necessary to effect a reduction of the pure oxides. The addition of burnt lime, with clay, glass, or borax, will aid the reduction and protect the reduced iron from combustion. *To reduce magnetic iron ore*, mix with ten parts of the ore, twelve of glass, twelve of chalk, and one of charcoal. For specular iron, with ten parts of the whole finely pulverized, mix as much chalk or limestone, six to eight parts of bottle glass, and a sixteenth or twentieth of the whole by weight of charcoal. *For brown hematite*, ten parts of burnt lime, as many of burnt clay, and three of charcoal. These proportions may be varied as the experimenter finds necessary. If the slag is clear, the reduction is perfect. If of a dark color, too much glass or clay may have been added, and it contains unreduced oxide; and if opaque, too much lime has been used. The ore when well mixed with the fluxes is placed in a crucible lined with damp charcoal dust, well compacted; the crucible is then filled with charcoal, and closed with a lid covered with fire-clay to prevent the escape of gases. The temperature should be raised slowly, and the ore kept at a white heat fifteen minutes; then the crucible may be removed and the button of cast iron, after cooling, taken out.

By the improved process in the reduction of ores, the ore is heated in a blast furnace along with charcoal, mineral coal, or coke, and also some flux, generally limestone. The carbon takes the oxygen which is in combination with the metal, while the lime forms a glass with the impurities of the ore. The first step in this process of reduction consists in piling the ore in heaps composed of alternate layers of coal or coke and ore, covering up the heap loosely with earth, and firing it. The furnace is slowly heated up with coal; ten or twelve days being required for this, to avoid the effect of too sudden heat on the furnace. The charge is next added, and is composed of coal, the roasted ore, and limestone. It is thrown in at the top of the furnace at intervals of half an hour or so. The charge at the top of the furnace is two days or more in descending to where it comes within the direct action of the blast. After the final fusion of the ore, the hearth fills with metal and slag, the latter of which is displaced by the fused iron and carried off by the workmen; the metal is let out below and run into moulds of sand, where it is formed into masses of about one hundred and eighty pounds each, called pigs. The color of the slag shows the success of the reduction. If it is light-colored, the reduction is perfect.

NATIVE LEAD is a rare mineral, having a specific gravity of 11.35.

GALENA belongs to the monometric system, and has perfect cleavage. It is composed when pure of lead 86.6 and sulphur 13.4, and occurs in granite, limestone, and sandstone rocks. It is found abundantly in the United States, and from it the lead of commerce is almost wholly derived. It is frequently used in glazing common stoneware. Galena is usually reduced by heat alone. After the ore is picked, pounded, and washed, the process of reduction consists simply in burning out the sulphur. The ore is kept at a heat below that required for its fusion, and air is admitted freely to assist in the combustion. The sulphur is thus driven off, and the pure lead left, or a slag which comes from an oxide formed by the process. This is again heated with charcoal and the oxygen separated.

COPPER occurs native, also as sulphurets, carbonates, and pyrites. Its specific gravity varies from 3.5 to 8.5, and its hardness seldom exceeds 4.

The ores of copper may be reduced in the wet way, by solution in strong nitric acid. If silver be present in the solution, it will appear at the bottom as a heavy white curdy precipitate; and if there be no lead in the solution, the copper may be precipitated by sulphuretted hydrogen and caustic potash. If the solution consists only of iron and copper, they may be separated by ammonia.

The process of the reduction of copper ores consists in alternate roastings and fusions. It is roasted or calcined either in the open air or in a reverberatory furnace. It is placed in the latter when the ores have not sufficient iron pyrites to furnish sulphur enough to sustain the combustion. After being calcined, the ore is transferred to the furnace, and after fusion is drawn off into water. This alternate process is repeated two or three times, till finally the metal is tapped into sand beds and formed into pigs. The pigs are again melted and the surface covered with charcoal, and the liquid stirred with a birch pole till the crystalline grain has disappeared, when it is ladled into moulds generally twelve inches wide by eighteen feet long. Copper is found in the United States in considerable quantities, the most extensive deposits being near Lake Superior.

Copper is largely employed for coinage, for the sheathing of ships, and for various utensils. It becomes *brass* when alloyed with zinc, and with tin it makes *bronze*, or *bell-metal*, according to the proportions.

ZINC. — The principal zinc ores are *blende*, the sulphuret of zinc, and *calamine*, the silicate of zinc.

The *calamine* is prepared for reduction by breaking the ore into small fragments, separating the impurities as far as possible, and then calcining in a reverberatory furnace. It is stirred frequently, and when taken out the water and carbonic acid are expelled. The prepared ore is then mixed with about one seventh by weight of charcoal, and reduced in large crucibles. The zinc, as it is reduced, rises in vapor and passes down the tubes into the condensers, where it collects in drops or powder, with some oxide. The metal is afterward melted and cast into bars; and the oxide which is skimmed off is returned to the crucibles.

The *blende* is roasted in a reverberatory furnace, and is then reduced in crucibles as above.

TIN. — Tin ore, or the oxide of tin, crystallizes in the dimetric system, and occurs in square prisms and octahedrons. It is composed when pure of 78.67 parts tin and 21.33 oxygen. It sometimes resembles a dark garnet and some varieties of tourmaline, but can be readily distinguished by its infusibility. It occurs in granite, gneiss, and mica slate, and is found in several parts of the United States. One of its most productive localities is Cornwall, England.

The ore is first pounded or stamped in a stamping mill, and then washed by running water. It is next roasted in a reverberatory furnace, so as to expel any arsenic or sulphur derived from the presence of other ores, and again washed. The ore is then generally mixed with pit-coal and a little lime, and strongly heated in a reverberatory furnace. After being kept in a state of fusion for some hours, it is drawn off into iron vessels. As it still contains some impurities, it is remelted at a lower temperature, and kept agitated for some time by wet charcoal or carbonized wood; it is then skimmed and run into blocks weighing from two hundred and seventy-five to three hundred and twenty-five pounds each.

In assaying tin ore, after it is pounded, washed, and roasted it should be mixed with lampblack or charcoal and heated quickly in a covered crucible to a white heat. A button of tin will be found in the crucible when it is removed from the fire. Carbonate of soda or borax may be added to the lampblack if the ore is not pure; and if the tin obtained is malleable and not brittle, the result is good.

GOLD. — Gold is mostly found native in rocks that abound in quartz veins. Those inexperienced in ores often mistake iron and copper pyrites for gold, but the latter may be readily distinguished by being easily cut in slices, and flattening under a hammer. Iron pyrites is too hard to yield at all to a knife, and when pounded is reduced to powder. The pyrites when strongly heated gives off sulphur, while gold melts without any odor.

Gold is distributed widely over the earth, and is found to a considerable extent in this country.

Gold is obtained by alluvial washings, by hand washing or panning, and by cupellation. A certain quantity of auriferous sand is washed in a shallow iron pan, and as the gold sinks the material above it is allowed to pass off into some receptacle. The greater part of the gold is thus left in the angle of the pan. The process is repeated till finally the gold is amalgamated with clean mercury; the amalgam is next strained to separate any excess of mercury, and finally is heated and the mercury expelled, leaving the gold. Mercury readily unites with gold, and thus separates it from any rock or sand with which it is connected.

When gold is alloyed with copper or silver, the process by which the copper is separated is called *cupellation*, while the silver is separated by nitric acid dissolving it without acting on the gold. The assay is heated in a small cup made of bone ashes, while the atmosphere has free access. The cup is placed in an oven-shaped vessel, called a *muffle*, which is inserted in a hole fitting it in the side of a vertical furnace. The oxygen of the atmosphere unites with the lead of the assay and produces an oxide, which sinks into the cup, leaving the silver or gold behind.

In the cupellation of gold which contains copper, lead is melted with the assay.

SILVER. — Silver is both native and alloyed. It occurs in octahedrons, and crystallizes in the monometric system. It is distinguished by being malleable, and can be known from bismuth and other white metals by affording no fumes before the blow-pipe.

Silver will dissolve in nitric acid, and can be precipitated from it by putting in a clean piece of copper.

In addition to native silver, the ores from which most of the silver of commerce is obtained are the *vitreous silver*, *brittle* or *black silver ore*, *red silver ore*, and *horn silver*. The silver ores are generally mixed with ores of lead, zinc, copper, and antimony, and are found in gneiss, trap, sandstone, limestone, and the shales.

The processes by which silver ores are reduced are based on the fact that both mercury and lead have a strong affinity for silver. By the *amalgamated* method, the silver ore is brought to the state of a chloride by a mixture of the powdered ore with about ten per cent of common salt; this chloride is reduced by metallic iron filings or sulphurets of iron; mercury is added, which combines with the liberated silver and thus separates it in the condition of an amalgam or compound of mercury and silver. After the mercury is put in, the mixture is kept constantly agitated till the process is finished. The excess of mercury is then filtered from the amalgam by a current of water, and is finally subjected to heat in a distilling furnace, by which the silver is left behind and the mercury evaporates. When the ore is argentiferous galena, the silver is separated from the lead in a reverberatory furnace. As the lead begins to cool the crystals are strained out with an iron strainer, that which is left behind containing nearly all the silver.

To reduce silver ores without quicksilver, the ore is calcined with common salt and converted to a chloride. A hot solution of salt being then poured over it, the chloride of silver is taken up and held in solution. The liquid, when transferred to another vessel, has the silver deposited by means of metallic copper.

MERCURY. — Mercury occurs native and alloyed with silver, also in combination with sulphur, chlorine, or iodine. It crystallizes in octahedrons in the monometric system, at a temperature of 39° Fahr. It occurs as a sulphuret in cinnabar, from which most of the mercury of commerce is obtained.

The process of reduction consists of the calcination of the pounded ore with quicklime (which combines with the sulphur) and the condensation of the resulting mercurial vapor by a stream of water passing through a trough in communication with the retorts. After filtering it is ready for packing.

PLATINUM. — Platinum occurs native in flattened or angular grains or irregular masses; also in combination with iridium, rhodium, and palladium, and occasionally with copper and iron.

Platinum is readily distinguished by its malleability and extreme infusibility. By the latter quality, in addition to its resistance to the action of the air and most acids, it is very valuable for the construction of chemical and philosophical apparatus.

When heated with iron, lead, and several of the metals it alloys readily; and as a consequence, care should be taken when heating it not to expose it to these agents. Platinum when found in grains is dissolved in nitro-muriatic acid, and by means of ammonic chloride an orange precipitate is thrown down from the solution. This precipitate is then heated and thus reduced to the metallic state, in the form of a black powder, commonly known as *platinum black*. This powder is compressed in steel moulds by the aid of heat and strong pressure, and when sufficiently compact is forged under the hammer and reduced to solid masses. *Platinum* "*sponge*" has been spoken of in Chemistry.

Nickel. — The nickel of commerce is obtained chiefly from copper nickel or arsenical nickel, which occurs massive, or from cloanthite or white nickel, which crystallizes in cubes in the monometric system. Its principal characteristic is that it does not rust or oxidize, from which fact it is used in the manufacture of many philosophical instruments. It is also used as an alloy of copper and zinc, which produces *German silver*, and is extensively employed in plating.

Bismuth. — Bismuth occurs native, with perfect cleavage in rhombohedral form, and generally massive. It also occurs in combination with sulphur, tellurium, oxygen, carbonic acid, and silica. The metal is obtained by heating the powdered ore in a furnace, when the bismuth melts, and separating from the gangue is drawn off into cast-iron moulds. When combined with equal parts of tin and mercury, bismuth forms *mosaic gold*, which is used for various ornamental purposes. It is also employed in the manufacture of the best type-metal.

Antimony. — Antimony is found native, also in combination with sulphur or sulphur and lead.

Native antimony crystallizes in the form of rhombohedrons, and is generally massive.

Gray antimony, or sulphuret of antimony, occurs in right rhombic prisms, and is that from which the antimony of commerce is obtained. It is distinguished by its fusibility and its vaporizing before the blow-pipe.

The crude antimony of the shops is obtained by placing the ore in crucibles having a hole at the bottom, which are inserted in other vessels; heat being applied above, the ore melts from its gangue and flows into the vessel below, where it becomes solid. This is reduced by roasting in a reverberatory furnace, thus obtaining a gray oxide. The oxide is then mixed with a tenth of its weight of crude tartar, placed in large melting-pots, and heated in a wind furnace. This being again melted with one fourth its weight of the oxide of antimony, the impurities form a slag above, leaving the metal beneath.

Cobalt. — The ores of cobalt are found in small areas and few localities, nearly all of which are in Europe. The arsenical ores — *cobaltite*, *smaltite* (tin-white cobalt, or cobalt glance), and *erythrite* (cobalt bloom) — furnish most of the cobalt of commerce. It is useless in the arts in a metallic state on account of the brittleness of its alloys; hence is chiefly used as an oxide in painting porcelain and pottery. The ores are generally of a reddish color, but give a deep blue color to glass of borax.

Manganese. — Of the ores of manganese, *pyrolusite* (dioxide of manganese) and its associate, *psilomelane*, are the most valuable, and are extensively used in bleaching and in discharging the brown and green tints of glass. The value of the ore depends upon the quantity of oxygen it contains and the readiness with which the oxygen is set free, which is usually effected by heating the pulverized ore with hydrochloric acid. The sulphate of manganese is used in calico printing, and gives a chocolate or bronze color.

PHYSICAL GEOGRAPHY.

PHYSICAL or *natural geography* is a description of the earth, the sea, and the air, with their inhabitants, animate and inanimate, so far as regards the distribution of these beings and the causes of that distribution. Political and arbitrary divisions are here disregarded; the sea and the land are considered only with respect to those great features which have been stamped upon them by the hand of the Almighty, and man himself is viewed but as a fellow-inhabitant of the globe with the other created beings, yet influencing them to a certain extent by his actions, and influenced in return. The effects of his intellectual superiority on the inferior animals, and even on his own condition by the subjection of some of the most powerful agents in nature to his will, together with the other causes which have had the greatest influence on his physical and moral state, are among the most important subjects of this science.

The former state of our earthly habitation, the successive convulsions which have ultimately led to its present geographical arrangement and to the actual distribution of land and water, so powerfully influential on the destinies of mankind, are circumstances of great importance.

The position of the earth with regard to the sun, and its connection with the solar system, have been noticed in our chapter on astronomy. It has been there shown that our globe forms but an atom in the immensity of space. The increase of temperature with the depth below the surface of the earth, and the tremendous desolation hurled over wide regions by numerous fire-breathing mountains, show that man is removed but a few miles from immense lakes or seas of liquid fire. The very shell on which he stands is unstable under his feet; which is shown, not only from those temporary convulsions that in their vicinity seem to shake the globe to its centre, but from a slow or almost imperceptible elevation in some places, and an equal, gentle subsidence in others, which show that the rocks were in one place expanded, and in another contracted, by changes of temperature.

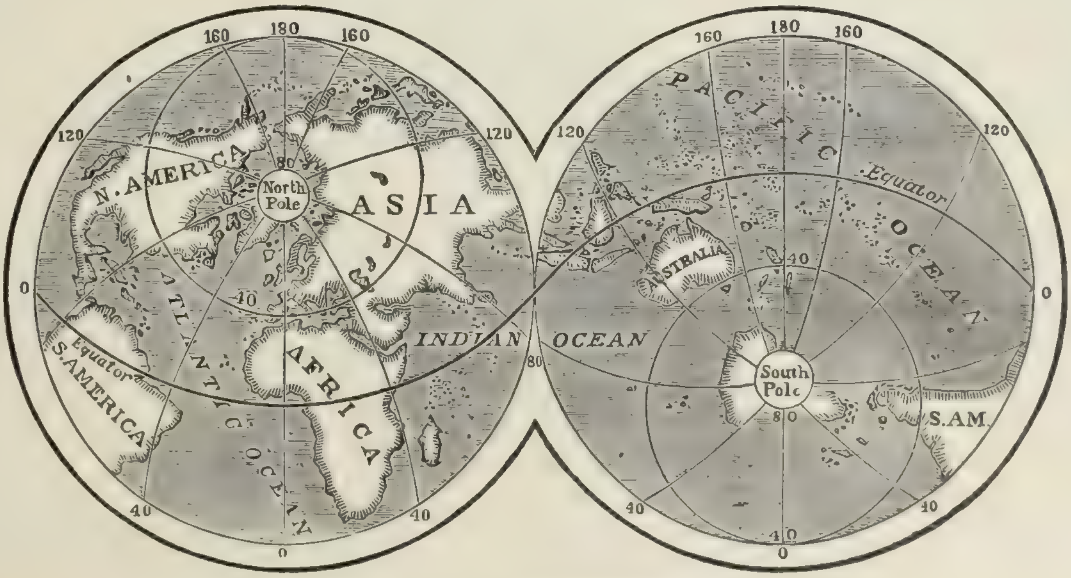
The earthquake and the torrent, the august and terrible ministers of Almighty power, have torn the solid earth and opened the seals of the most ancient records of creation, written in indelible characters on the "perpetual hills and everlasting mountains." In geology (see Geological Department) we read of the changes that have brought the rude mass to its present fair state, and of the myriads of beings that have appeared on this mortal stage, have fulfilled their destinies, and have been swept from existence to make way for new races, which in their turn have vanished from the scene, till the creation of man completed the glorious work. Who shall define the periods of those mornings and evenings when God saw that his work was good? and who shall declare the time allotted to the human race, when the generations of the most insignificant insect existed from unnumbered ages? Yet man may also vanish in the ever-changing course of events, the earth be burned up, and the elements melt with fervent heat, to be again reduced to chaos, possibly to be renovated and adorned for other races of beings. These stupendous changes may be but cycles in those great laws of the universe, where all is variable but the laws themselves and He who has ordained them.

We spoke in our chapter on astronomy of the earth as one of the planets in our solar system, pointed out its place among the heavenly bodies, mentioned the influence which the sun has on the earth and the moon on the tides, gave a description of the form, size, atmosphere, motions, and other circumstances of our globe; and we will here proceed to speak of

THE CRUST OF THE EARTH.

Internal Heat of the Globe. — The earth becomes warmer the deeper we descend into the interior, as in mines and deep borings of wells. The temperature rises about 1° for every fifty feet of descent, and it was therefore at one time inferred that the globe consisted of a molten fluid core enveloped in a cooled and hardened rind or crust. This opinion has recently been opposed by several scientists, who show quite clearly that the centre of the earth is solid, but that the surface is of a honeycombed structure, and that there are here and there lakes of molten matter contained in the cavities, which cause volcanic eruptions.

Extent and Distribution of Land and Water. — Our earth has a diameter of 8,000 miles, and a surface of about 200,000,000 square miles; of this space, only 52,000,000, or a little more than a fourth of the whole, consists of land, the other three fourths being covered by sea. There is much more land in the northern half of the world than in the southern.



Northern and Southern Hemispheres.

Divisions of the Land. — The dry land consists mainly of two great masses, one lying in the eastern hemisphere and known as the Old World, the other lying in the western hemisphere and called the New World, from its having been unknown to the inhabitants of the Old World until less than four hundred years ago. These masses are broken into by inlets of the sea, and are thus cut up into several lobes, as it were, which receive the name of continents. In the Old World there are the continents of Europe, Asia, Africa, and Australia. The land in the New World is divided into the continents of North America and South America, which are connected by the Isthmus of Panama. Australia is by some considered as an island, while it and all the islands which intervene between the southeast shores of Asia and the west shores of America are called Oceanica.

In point of extent, as roughly estimated, these six divisions rank as follows: —

	Area in Square Miles.	Relative Size.
Europe	3,500,000	1
Australia	3,000,000	6-7
South America	7,000,000	2
North America	8,000,000	2 2-7
Africa	11,500,000	3 2-7
Asia	16,000,000	4 4-7
	49,000,000	14

Islands are portions of land completely surrounded by water; those adjoining the continents are called continental islands, and those in mid-ocean oceanic islands. The area of all the islands on the globe is estimated at 3,000,000 of square miles, making only one seventeenth of the whole land surface. The largest islands (not including Australia) are: —

	Square Miles.		Square Miles.
Greenland	380,000	Celebes	70,000
Borneo	280,000	Java	51,000
New Guinea	274,500	Newfoundland	40,000
Madagascar	234,000	Iceland	40,000
Sumatra	177,000	Cuba	36,000
Niphon	109,000	Ireland	32,000
Great Britain	83,828	Ceylon	25,860

Divisions of the Water. — Unlike the dry land, the water of the globe is not divided into detached masses; excepting the inland lakes and rivers, it is all connected, and vessels can sail over it. There is thus only one ocean. In different places it is called by different names, and is generally divided into five parts, called the Atlantic Ocean, between the western coasts of the Old World and the eastern coasts of the New; Pacific Ocean, between the eastern coasts of the Old World and the western coasts of the New; Indian Ocean, south of Asia and east of Africa; Arctic Ocean, lying round the North Pole; Antarctic Ocean, lying round the South Pole.

Some reckon a sixth ocean, comprising the part of the Antarctic Ocean outside the Antarctic Circle, and call it the Southern Ocean. The areas of these divisions of the ocean are roughly as follows:—

	Square Miles.
Pacific Ocean	70,000,000
Atlantic Ocean	25,000,000
Indian Ocean	20,000,000
Arctic Ocean	4,000,000
Antarctic Ocean	4,000,000

THE LAND.

Form of the Land. — The greatest length of the Old World is from east to west. The greatest length of the New World is from north to south. Accordingly Europe and Asia lie mostly in similar zones of climate, while America crosses nearly all the zones.

Coast Lines. — Perhaps the most important point to note is whether the outline is uniform or indented. In this respect the greatest contrasts are presented. Africa has the simplest shape, — a body without members. There is hardly an inlet where a ship can find shelter round its whole outline. South America and Australia have much the same character. Asia throws out numerous limbs into the ocean, and receives corresponding bays. Europe has the most varied outline. North America, especially on its east side, resembles Europe in the extent and broken character of its outline. This peculiar structure of Europe and North America affords singular facilities for commerce and for developing the internal resources of their inhabitants, and the progress of their civilization corresponds.

On comparing the length of the coast line of the continents with their areas, it is found that —

Europe has	20,000	miles of coast,	or one mile	for every	200	square miles	of area.
North America,	28,000	"	"	"	286	"	"
Australia,	7,600	"	"	"	395	"	"
South America,	15,000	"	"	"	467	"	"
Asia,	35,000	"	"	"	486	"	"
Africa,	16,000	"	"	"	720	"	"

Upright Outline. — The great elevations of a continent lie in the direction of its greatest length, and in all continents the line of the greatest elevation is not in the centre, but more toward one side than the other. From this result two slopes of unequal length and inclination, the long slope being called the *slope* and the shorter one the *counter-slope.* The slope, of course, produces lengthened rivers; the counter-slope, short and rapid ones. The Old World rises by a long, gentle slope from the Northern and Atlantic Oceans, and descends abruptly to the east and south; the New World has long and gentle slopes toward the Atlantic and Northern Oceans, but a rapid descent to the Pacific. These facts account for the number of large rivers that flow into the Atlantic and Arctic Oceans. In all continents the elevations increase from the poles to the tropics. The effect of this arrangement is to temper the burning heats of the tropical regions and to give them a variety of climate.

Size of Mountains in Proportion to the Globe. — Mount Everest, the highest mountain in the world, although five and one half miles high, is nothing more on the earth's surface than a grain of sand $\frac{1}{81}$ of an inch in diameter on the surface of an 18-inch artificial globe; and were all the land of a continent reduced to a uniform level, its whole height above the sea surface would not be greater in proportion than a coat of varnish on such a globe.

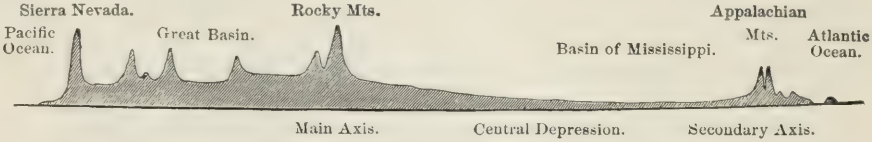
Mean Elevation of Continents. — The mean elevation of North America has been estimated at 750 feet; of South America, at 1,130 feet; of Europe, at 670 feet; of Asia, at 1,150 feet; of Africa, at 900 feet; the whole land of the globe, at nearly 1,000 feet.

MOUNTAINS.

Mountains generally appear in chains or ranges; several chains are usually combined into a system, and when several ranges are more or less connected they are called a group.

The chief mountain systems of the globe, classified by their geographical location, are as follows: —

Central and North America. — The Mexican Andes or Cordilleras extend from the Isthmus of Panama to the North of Mexico, from sea to sea. At Panama, where they are crossed by a railway, they are not quite three hundred feet high, but their height increases toward the north. Within the United States and British America they are known by the general name of the Rocky Mountains. The latter consist of several systems parallel to each other and to the Pacific coast, and between that coast and the head waters of the streams that flow into the Mississippi, and extending over a tract one thousand miles broad from east to west. The highest point east is Fremont's Peak, 13,570 feet. The western chains attain in the Sierra Nevada of California a height of 14,000 feet; and in Mount St. Elias, on the coast, a height of 17,940 feet. The Alleghanies or Appalachians, on the east side of the continent, extend in parallel ranges, with valleys between them, from Alabama to Maine; the highest summit of their eastern range, which is called the White Mountains in New Hampshire, is 6,634 feet.



TYPICAL FORM OF CONTINENTS SHOWN IN NORTH AMERICA.

South America has the Cordillera of the Andes (*cordillera* means a chain), and the mountains of Brazil. The highest peak of the system is in Chili, where Aconcagua is 22,301 feet, perhaps the highest volcano in the world; Chimborazo, near the equator, is 21,424. The Andes present a most magnificent spectacle: the snow which permanently covers their lofty summits, even under the burning sun of the equator, contrasting beautifully with the deep blue of the sky beyond, while occasionally another contrast is exhibited in vast volumes of smoke and fire emitted from some of the numerous volcanoes which stud the entire chain of the mountains. The Brazilian Mountains occupy a great breadth of the country, but seldom exceed the height of 6,000 feet.

Europe has: The Spanish system; the culminating point is Maladetta, in the Pyrenees, 11,168 feet. The French system; highest point a peak in Auvergne, 6,113 feet. The Alpine system in Switzerland, the Apennines in Italy, and the Balkan group in Turkey; the highest point is Mont Blanc, in Switzerland, 15,732 feet. The Carpathian system, between the Rhine, Dnieper, and Danube, Northern Germany and Western Poland. The Scandinavian system, in Norway and Sweden. The Ural system, between Europe and Asia. Lastly, the Britannic system, the Grampians, Cheviots, and Welsh mountains; the highest point is Ben Nevis, in Invernesshire, 4,406 feet.

Asia has: The Altaï, an Alpine girdle, whose greatest height is 12,790 feet. Thian-shan and Kuen-lun, two ranges running into China, with summits upward of 20,000 feet, and containing active volcanoes. The great Himalaya mass, extending about fifteen hundred miles in length, and from one hundred to one hundred and sixty across, attains in Mount

Everest over 29,000 feet, the highest on the globe. The Hindu Kush, which are conconnected with the Himalaya; and lastly the Tauro-Caucasian system, whose highest is Demavend, 21,000 feet.

Africa has: The summits of the Nieuveldt and Smeuveldt Mountains in the Cape Colony, about 10,000 feet high. The Lupata Mountains; highest point about 20,000 feet. The Abyssinian Mountains, reaching 15,000 feet. The Cameroons, about 13,000 feet; and the Atlas system, between the Sahara and the Mediterranean, 11,400 feet high.

HEIGHT OF SOME OF THE PRINCIPAL MOUNTAINS OF THE WORLD.

(*See Map.*)

Eastern Hemisphere.

			FEET.
1.	Mt. Everest, or Guarisanker,	Himalaya Mts.	29,002
2.	Kunchinginga,		28,178
3.	Dhawalagiri,		28,073
4.	Kilimanjaro, Africa,		20,000
5.	Elburz Mts.,	Average height	18,000
6.	Kuenlun "		18,000
7.	Mt. Blanc,	Alps,	15,700
8.	Mt. Rosa,		15,100
9.	Matterhorn,		14,800
10.	Jungfrau,		13,700
11.	Schreckhorn,		13,400
12.	Peak in Sumatra,		12,000
13.	Peak in Atlas Mts.,		11,000
14.	Mt. Etna, Sicily,		10,790
15.	Peak in Java,		9,200
16.	Mt. Olympus, Turkey,		9,000
17.	Highest Apennine,		9,000
18.	Mt. Sinai,	Arabia,	8,500
19.	Mt. Horeb,		8,000
20.	Scandinavian Mts.,		7,500
21.	Australian Alps,		7,200
22.	Altai Mts.,		7,000
23.	Mt. d'Or, France,		6,000
24.	Mt. Hecla, Iceland,		5,110
25.	Ben Nevis, Scotland,		4,500
26.	Mt. Vesuvius, Italy,		3,932
27.	Mt. Brocken, Germany,		3,700
28.	Table Mt., So. Africa,		3,582
29.	Mt. Snowdon, Wales,		3,500
30.	Peak in Ireland,		3,500
31.	Black Forest,		3,000
32.	Hartz Mts.,		2,000

Western Hemisphere.

			FEET.
1.	Tupungata,	Andes,	22,450
2.	Aconcagua,		22,301
3.	Sahama,		22,300
4.	Chimborazo,		21,424
5.	Picacho,		19,200
6.	Cotopaxi,		18,875
7.	Mt. St. Elias, Coast Range,		17,940
8.	Popocatapetl,	Mexico,	17,881
9.	Orizaba,		17,373
10.	Mt. Brown,	Rocky Mts.,	15,990
11.	Mt. Hooker.		15,700
12.	Peak in New Zealand,		15,000
13.	Mt. Fairweather,		14,708
14.	Mt. Shasta, S'a Nevada,		14,440
15.	Pike's Peak, Rocky Mts.,		14,000
16.	Kea, Sandwich Islands,		13,953
17.	Fremont's Peak, Rocky Mts.,		13,570
18.	Mt. Hood, Cascade Range,		12,500
19.	Peak on Teneriffe,		12,000
20.	Mt. Jefferson, Cascade Range,		11,000
21.	Chiriqui, Central Amer.		11,000
22.	Cape Verde Islands,		9,000
23.	Mt. St. Helen's, Cascade Range,		9,000
24.	Cuba Range,		7,000
25.	Hayti Range,		7,000
26.	Clingman's Peak,	Appalachian Ranges	6,941
27.	Mt. Mitchell		6,732
28.	Mt. Washington,		6,634
29.	Mt. Adams,	White Mts.,	5,963
30.	Mt. Jefferson,		5,860
31.	Black Mts., Appalachian Range,		5,700
32.	Mt. Marcy, Adirondacks,		5,467
33.	Mt. Katahdin, Me.,		5,385
34.	Mt. Mansfield, Vt.,		4,400
35.	Jurullo, Mexico,		4,200
36.	Mt. Monadnock, N.H.		3,450

TABLE-LANDS.

Mountains mostly take their rise on elevated tracts called *table-lands* or *plateaux*. A considerable portion of the earth's surface is occupied by such plateaux.

New World. — The parallel ranges of the Rocky Mountains enclose several elevated uplands, such as Utah, the seat of the Mormons. The whole country of Mexico is 4,000 to 9,000 feet high. The city of Quito, in South America, stands at an elevation of 9,000 feet. Europe, with the exception of Spain and the level part of Switzerland, has no table-lands. In Africa some parts of the Sahara are elevated. The loftiest and most extensive table-lands occur in Asia. The whole of the central portion of Eastern Asia is one vast elevated tract; the natives call it "the roof of the world." The plateau of Thibet rises as high as 17,000 feet.

LOWLAND PLAINS.

The New World has a great plain in the northern continent between the Rocky Mountains and the Alleghanies, and in the southern between the Andes and the mountains of Brazil. Much of the Mississippi plain is well watered by minor rivers, exhibiting broad grassy prairies and extensive pine forests. In South America the low country skirting the shores of the Pacific is from fifty to one hundred miles in width, and about 4,000 in length; fertile at its extremities, but sandy in the middle; next the basin of the Orinoco, consisting of extensive plains called *llanos*, covered in the dry season with the naked trunks of palms, and in the rainy season with tall herbage; then the basin of the Amazon, a vast plain, of nearly 2,000,000 square miles, possessing a rich soil and humid climate, and almost entirely covered with dense forests and large marshes by the riversides; then the great open plains of the Plata, called *pampas*, partly barren and partly covered with tall grasses.

In the Old World the plains occupy nearly a third of Europe, embracing Belgium, Netherlands, Denmark, North Germany, and Russia in Europe. The South of Russia is occupied by *steppes*, or treeless plains, partly covered with coarse grass. The middle plains in Europe, especially those of the Danube, furnish the chief corn-growing area of the temperate zone. One third of Asia is also lowland. Although many level tracts are sandy and barren, yet the richest parts of the earth's surface and the chief seats of civilization are in the plains.

VALLEYS.

Valleys are the counterpart of mountains, being depressions below the level of the surrounding surface. Valleys present a great variety of aspects, from the narrow gorge with precipitous sides, called a *cañon*, to the wide hollow merging into a plain. Valleys, with the streams that traverse them, are among the most pleasing features of landscapes; and the valley lands bordering the streams furnish the richest of all soils. The Mississippi Valley and other valleys in the United States are of boundless fertility and healthful climate. The valley of the Nile and that of the Euphrates were among the earliest scenes of agriculture and civilization.

THE OCEAN.

Forms of Oceans. — The forms of the several oceans are better learned by inspection of a map of the world than from verbal description.

Depth of the Ocean. — A great part of the floor of the ocean is becoming almost as well known as the surface of the land. By means of sounding — that is, letting down a heavy weight attached to a line — we can measure the depth of the water; and by dredging with a net, specimens of the bottom are brought up, together with the creatures that live there, — for life in great variety is found to exist at vast depths. The bottom of the sea is nearly as uneven as the surface of the land. In some places there are great plains, in others there are rocky ridges, rising sometimes to the surface or near it, and forming islands or sunken reefs. The ocean is shallowest near the land, except in the neighborhood of a precipitous coast.

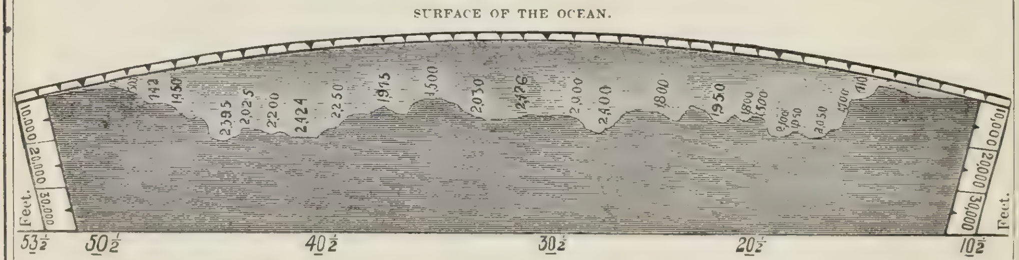


Diagram of the bed of the Atlantic Ocean on the line of the telegraph cables, from Newfoundland to Valentia, Ireland. The numbers above the ocean bed represent its depth in fathoms. The figures beneath the cut represent degrees of longitude, reckoned from Greenwich, England.

The greatest depth yet measured with certainty in the South Atlantic is 23,400 feet, or nearly four and a half miles. In the Pacific a depth has been ascertained of 26,850 feet, or more than five miles, which is nearly equal to the height of the highest mountain in the world. It is only recently that the art of sounding the depths of the ocean has been so improved as to be almost reliable. Depths of nine miles used to be reported, but they can scarcely be accepted as correct.

Its Pressure. — A cubic foot of water weighs sixty-two pounds. At the depth of one thousand feet a column of water weighing 62,000 pounds rests on every square foot; yet multitudes of creatures live at a depth and under a pressure of twenty-seven thousand feet of water. Some of them die when brought to the surface, and even burst from the expansion of the air within them.

Saltness of the Ocean. — Every one hundred pounds of sea-water contains three and a half pounds of solid matter and by far the greater part of this is common salt. If you put sea-water into a flat plate, and set it aside till it has evaporated, you will find the bottom of the plate sprinkled with small crystals of common salt. The question is sometimes asked, Whence did the sea get its saltness? Salt is one of the ingredients that make up our globe, just as clay or quartz is; and when the water was gathering at first into the hollows, it carried much of such a soluble substance as salt along with it. This original saltness must ever since have been on the increase, for the water that falls from the clouds is continually dissolving the soluble parts of the solid earth and carrying them into the sea. There they must remain, for the evaporation that sends the water back again to wash the earth carries none of the mineral matter back with it: vapor rising from the sea has no salt or other mineral matter in it. The saltness of the sea is not quite uniform: it is greater where there is great evaporation; a rainless sea, like the Red Sea, is salter than the rest of the ocean. The Dead Sea contains twenty-four per cent of salt; its southern shore is a bed of salt. Out of the lime and flint in the sea are formed the innumerable little animals which cover the bed of the ocean; the reefs of coral are also built of lime by the coral polyps.

The temperature of the sea at or near the surface is about the same as that of the air above it. An icy coldness prevails over the whole deep-sea bed even at the tropics.

The movements of the ocean keep on all the time, and are its waves, currents, and tides.

The *waves* are moved by the winds The greatest waves are only about forty feet high.

The rate at which the waves travel depends upon their length and the depth of the water. A wave one thousand feet long and in water ten feet deep travels twelve miles an hour; in water one hundred feet deep, thirty-six miles; and in water one thousand feet deep, forty-nine miles. But it is only the wave's form that travels, rising up and sinking down with the regularity of a pendulum, and the water remaining all the while nearly in the same place. It is like shaking one end of a stretched rope, when it will move along in bent lines to the other end, without the rope itself advancing.

When a wave, however, comes near the shore, where the bottom interferes with the rising and sinking of the water, the foot of the wave is held back, and the top keeps forward and *breaks*, sometimes with great force.

Waves do not disturb the ocean to any great depth; under the most violent storm, the sea is tranquil at the depth of about four hundred feet.

The waves wear away the shores against which they break; the softer parts into bays, and leaving the harder parts standing out as promontories and headlands, or forming rocky islets.

The force of waves is immense: blocks of eight hundred tons' weight have been displaced by the waves.

The waves wear away the cliffs, not only by the force of the water itself, but by the loose gravel and stones which they dash against the rocks, sometimes dragging and sometimes hurling, with a deafening noise, cart-loads of pebbles. It is this rubbing of the pebbles against one another, and against the rocks, that has given them their rounded forms and smooth polish, for not long ago they were unshapely stones.

Countless millions of such pebbles have been formed by the grinding power of breakers. In some parts of the coast the land is wasted away at the rate of a yard a year; in others, the rocks are so hard that the waste is smaller.

In *currents*, the water is transferred from one place to another.

Currents are to the ocean what winds are to the air. If you row a boat straight across a river, you will not land at the point opposite that you started from: you will find yourself carried out of your direct course by the current. This often happens to ships at sea: they come upon currents, veritable rivers in the ocean, and are carried out of their course by them.

Such of those ocean currents as are known and constant are laid down on all charts or sailing maps, that the mariner may be on his guard, and make allowance for them in shaping his course.

Currents are caused by the difference of temperature, and by prevailing winds; also by the revolution of the earth on its axis.

Currents and winds have opposite distinctions: for instance, an easterly current means a current flowing *toward* the east; an easterly wind is one coming *from* the east.

The difference of heat between the tropics and the polar regions causes the circulation of air from the poles to the tropics and back again; and the same cause produces a like effect on the ocean.

Water is expanded and made lighter by heat; it is contracted and made heavier by cold. The heavier polar waters sink down and flow in below the waters lying nearer the equator, while these lighter waters flow over toward the poles to restore the level; hence there is ice-cold water at the bottom, even under the equator.

The currents caused by temperature move the whole mass of waters from top to bottom, and those caused by winds move only the surface. Sometimes the winds blow long and steadily in the same direction.

The *equatorial current* sets from the west coast of Africa to the east coast of Brazil. It is owing to the trade-winds, which push the surface waters of the Atlantic westward. When it reaches the coast of Brazil it divides into two branches: one proceeds southward, turning gradually eastward across the Atlantic; the other and much larger branch forms what is called the Gulf Stream, and is deflected northward into the Caribbean Sea, and then to the Gulf of Mexico, and thence between Florida and the Bahama Islands. It proceeds from the Florida Gulf at first northward, parallel to the American coast; but after coming to Cape Hatteras it turns eastward, passing over the southern end of the banks of Newfoundland, and all the while expanding in breadth.

The temperature of the stream when it starts is from 83° in summer to 77° in winter; and even after travelling three thousand miles to the north, there is a difference in a winter day between its water and that of the surrounding ocean of about 30°.

A cold polar current flows between it and the shore as far as New York, and underlies it near the coasts of Florida, Georgia, and the Carolinas; the line is so well defined between them that it is known as the "cold wall." The velocity of the stream at its outset is about sixty miles a day, but it decreases gradually.

There are many currents in every part of the ocean, and they serve to mitigate the extremes of heat and cold in the different regions of the globe. The currents causing the waters to sink down and rise up are necessary to the existence of the creatures that live in the depths of the sea. If waters from the surface did not carry with them fresh oxygen, and vegetable and animal matter, these creatures would perish as in a stagnant pool.

TIDES. — We have explained the tides and their causes in our chapter on astronomy, and will add here only some remarks in regard to the velocity and height of the *tidal wave*. It moves most quickly where the ocean is deepest; and in narrow, shallow channels it travels more slowly. So it moves in the Southern Ocean at the rate of one thousand miles an hour; in the German Ocean, about fifty miles.

In the open ocean the tide is from three to eight feet high; in such inlets as Fundy Bay, which, opening broadly and narrowing inwards, prevent the water from spreading on the sides, it reaches a height of seventy feet. The waters of the tide accumulated into a high mass are termed a *bore;* the reverse are called *neap* (scanty) tides.

RIVERS.

"A river," says Pliny, "springs from the earth, but its origin is in heaven. Its beginnings are insignificant, and its infancy frivolous; it plays among the flowers of a meadow, it waters a garden, or it turns a little mill. Gathering strength in its youth, it becomes wild and impetuous. Impatient of the restraints which it still meets with in the hollows, among the mountains, it is restless and fretful, quick in its turnings and unsteady in its course. Now it is a roaring cataract, tearing up and overturning whatever opposes its progress, and it shoots headlong down from a rock; then it becomes a sullen, gloomy pool, buried in the bottom of a glen. Recovering breath by repose, it again dashes along till, tired of the uproar and mischief, it quits all that it has swept along, and leaves the opening of the valley strewed with the rejected waste. Now quitting its retirement, it comes abroad into the world, journeying with more prudence and discretion through cultivated fields, yielding to circumstances, and winding round what would trouble it to overwhelm or remove. It passes through populous cities and all the busy haunts of man, tendering its services on every side, and becomes the support and ornament of the country. Now increased by numerous alliances, and advanced in its course of existence, it becomes grave and stately in its motions, loves peace and quiet, and in majestic silence rolls on its mighty waters till it falls into the vast sea."

A great part of the rain falls directly into the sea and helps to replace what the sea had lost by evaporation. What falls on the land serves for the most part to wet the surface soil and nourish vegetation, and is then evaporated; the rest sinks deep into the rocks below and comes out again at a lower level as a spring, and springs help to feed rivers.

The trench that a river runs in has been scooped out by the river itself in the course of ages, and is called its channel, or bed. A river always follows the lowest level of the region through which it flows. The law of gravity, which draws all things toward the centre of the earth, always impels water down the lowest course.

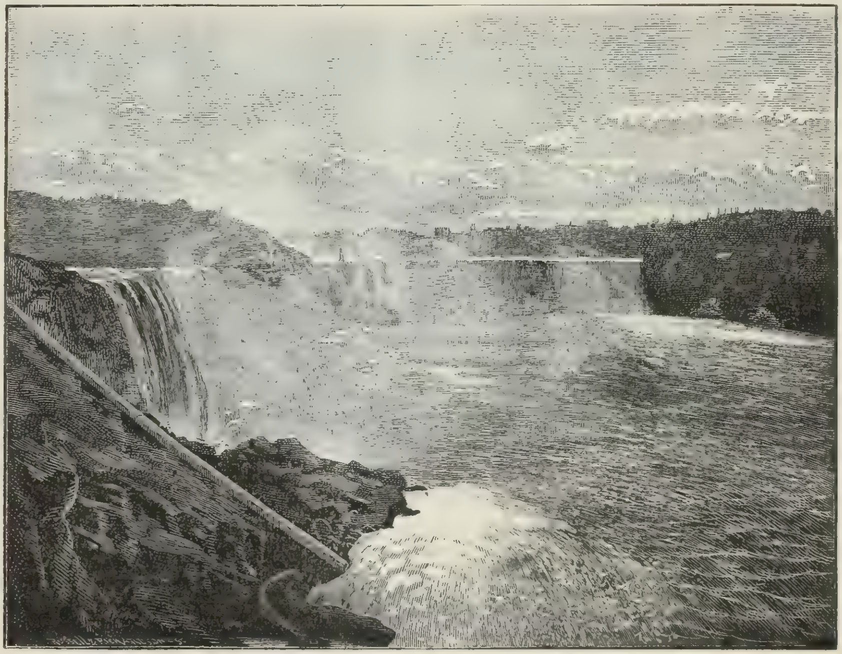
The sides which bound a river bed are its banks; and when we call one the right bank and the other the left bank, we are supposed to be looking down the stream.

The streams falling into a main river are called its tributaries, and the point where they join is their confluence. The junction of a river with the sea is its mouth. When a river appears to end in a lake, it will be found issuing at another place, and pursuing its way to the sea. Very few rivers are lost or dried up in sandy deserts, or fall into lakes without any outlet, though the plateau of Utah has a river of this class.

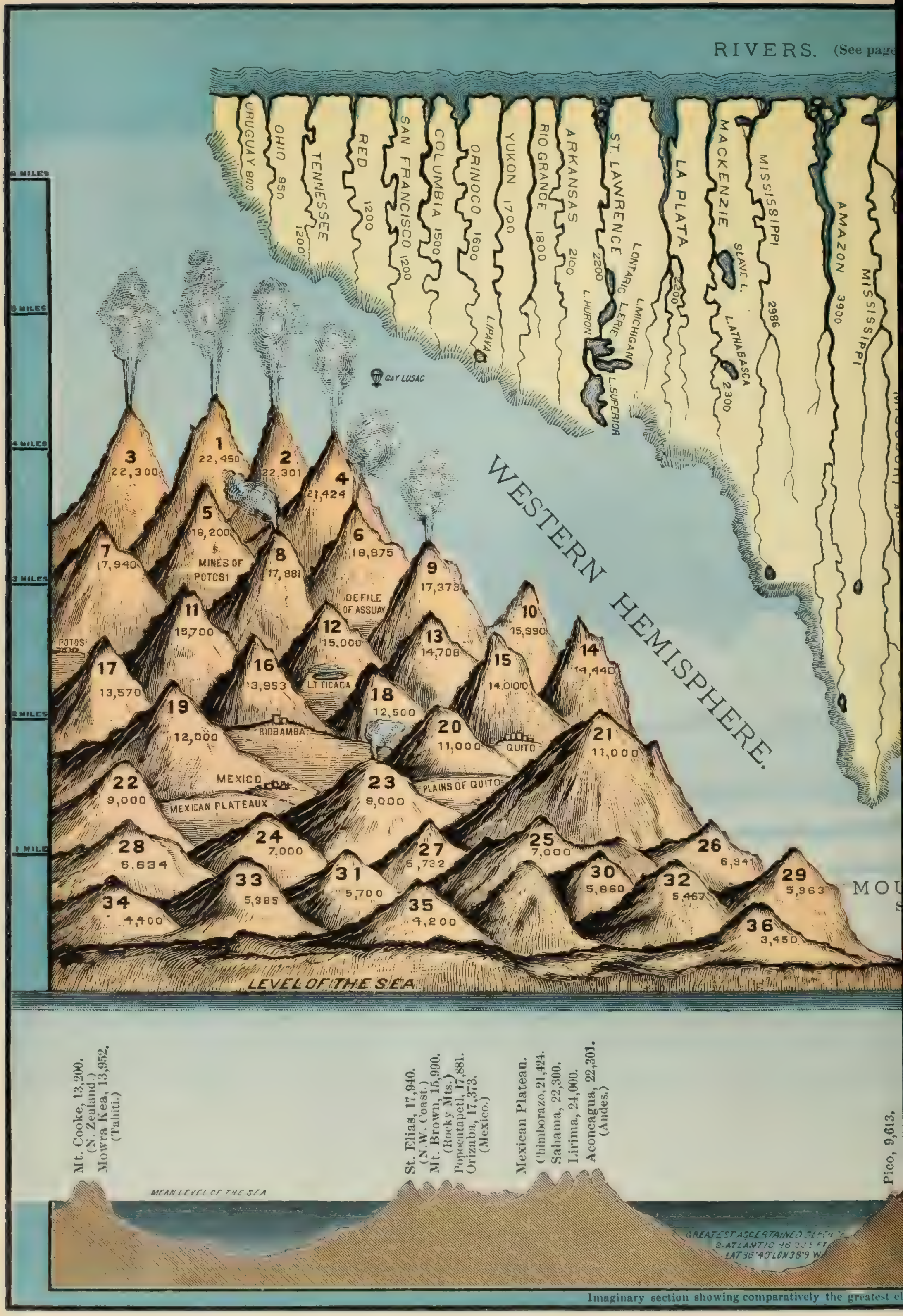
The land drained by a river and its tributaries is called its basin, and the elevated land between two river basins is called a water-shed, because it parts the waters and makes them flow in opposite ways. The basin of the Mississippi drains nearly a million square miles of land; on the west it consists of the ridges of the Rocky Mountain range, and presents many beautiful views. It unites the Missouri, Arkansas, and Ohio; each of these magnificent rivers and their tributaries unite with the Mississippi, which is navigable to St. Anthony's Falls in Minnesota, 2,240 miles. But the navigation is dangerous on account of numerous trees, which are swept down by the floods, the trunks lying on the bottom and the tops partly or wholly under water; there are also obstructions caused by accumulations of drift: but large sums have already been expended, and the government in 1882 appropriated several millions, and will no doubt in future continue to provide sufficient money to regulate this important navigation, and thus promote both the welfare of the rapidly increasing population of this region and the general interests of the people of the whole United States. On the magnificent river system of this country and its extensive coast line depend principally its great advantages over other countries.

A main river with its affluents or tributaries is sometimes called a river system, but this term often signifies all the rivers that fall into any one sea.

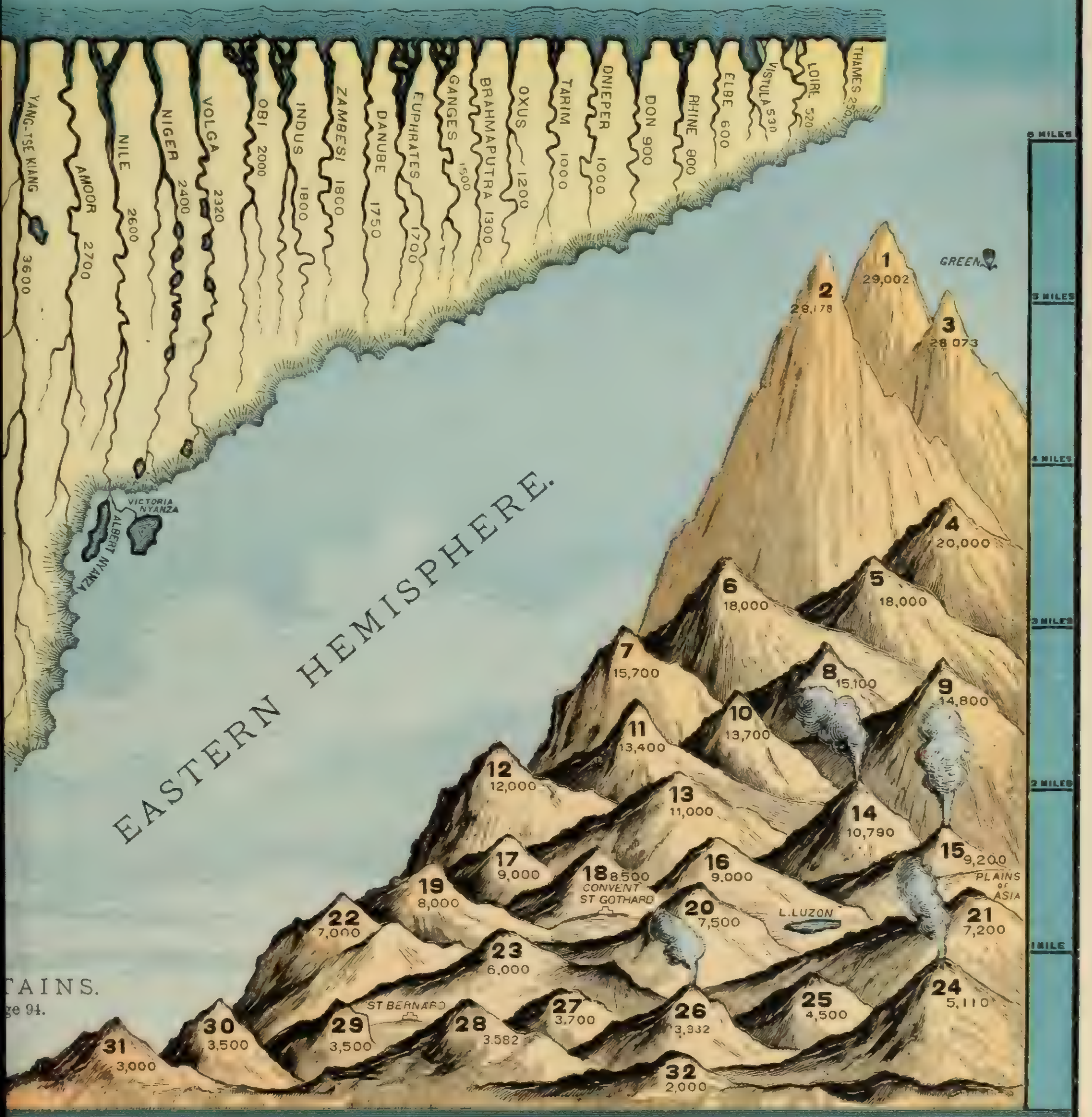
When rivers flow over a rocky precipice, they form falls or cataracts; and in case of a swift descent without a high fall in any one place, they are called rapids. Falls and rapids are of frequent occurrence, as the falls of the Rhine and Staubbach in Europe, Victoria Falls in Africa, and many others. The loftiest waterfall in the world is one of the three Yosemite Falls in California, where a tributary of the Merced River makes a single leap of 2,360 feet over a precipice of the Sierra Nevada. But the largest and most magnificent cataract on the globe is the stupendous Falls of Niagara in North America; the total breadth of the river St. Lawrence (which is divided into two great cataracts by Goat Island, situated between the lakes Erie and Ontario) being 3,225 feet, with a depth of descent of one hundred and sixty-two feet in the one fall and one hundred and forty-nine in the other. The action of the water cuts back the cliff over which it falls at the rate of a foot per annum.



FALLS OF NIAGARA.



Imaginary section showing comparatively the greatest el cale, 1,000 miles to an inch.)



TAINS.

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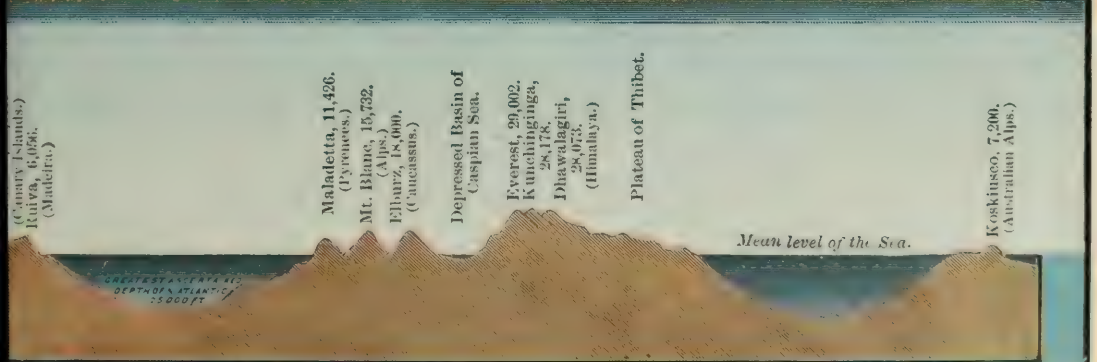

(Canary Islands.)
Ruiva, 6,056. (Madeira.)
Maladetta, 11,426. (Pyrenees.)
Mt. Blanc, 15,732. (Alps.)
Elburz, 18,000. (Caucasus.)
Depressed Basin of Caspian Sea.
Everest, 29,002. Kunchinginga, 28,178. Dhawalagiri, 28,073. (Himalaya.)
Plateau of Thibet.
Mean level of the Sea.
Koskiusco, 7,200. (Australian Alps.)
GREATEST ASCERTAINED DEPTH OF N. ATLANTIC 25000 FT

of land and greatest ascertained depressions of the sea

It is obvious that the precipitation of such a volume of water from such heights must produce very imposing effects: roaring sounds, and a varied play of light on the clouds of vapor and waves of foam carried up by the winds. "The loud, solemn, all-pervading roar of the waters," says the famous German traveller Gerstäcker, who has visited the falls, "is so awful that no language is adequate to describe it. The great commotion of the waters of the base is concealed by thick clouds of mist, which, on ascending to a certain height, are borne away by the winds. The water, from violent agitation, is perfectly white for some distance below the falls, and tilts up and down like a little sea, producing a thick cream-colored foam, which is seen floating down in large beds. The sublimity of the scene cannot be exceeded. It is impossible to convey by words the mingled feeling of weakness and sublimity that arises in the human breast at the sight of this stupendous cataract; we can only wonder and admire." The sound is heard, and the clouds of vapor are seen, at a distance of forty miles.

One of the falls is called from its form the Horseshoe Fall, situated on the Canadian side of the river; the other the American Fall, from being on the side of the United States. The Horseshoe Fall is about six hundred feet wide and one hundred and forty-nine feet high, taking the unbroken sweep of the waters; but reckoning from where the rapids above begin to descend, the height may be estimated at more than two hundred feet. Just in the middle of the circular wall of waters of the two falls is the insulated rock named Goat Island, which has braved the fury of the current, and is about five hundred yards in extent north and south. The American Falls are about two hundred yards wide and one hundred and sixty-two feet high.

The following is a comparative view of the length of the principal rivers:—

Names.	Length in Miles.
America:	
Missouri and Mississippi	4,506
Amazon	3,900
Mississippi	2,986
Mackenzie	2,300
La Plata	2,200
St. Lawrence	2,200
Arkansas	2,100
Rio Grande	1,800
Columbia, or Oregon	1,500
Ohio	950
Europe:	
Volga	2,320
Danube	1,750
Dnieper	1,000
Don	900
Rhine	800
Elbe	600
Vistula	530
Loire	520
Thames	250
Asia:	
Yang-tse-Kiang	3,200
Amoor	2,300
Obi	2,000
Indus	1,800
Euphrates	1,700
Ganges	1,500
Brahmaputra	1,300
Oxus	1,200
Tarim	1,000
Africa:	
Nile	3,600
Niger	2,400
Zambesi	1,800

SPRINGS.

We explained the way in which springs originate. When the depth to which the rain-water descends into the earth is several thousand feet, a hot spring is the result. Spring water usually contains dissolved parts of the earth through which it percolates; and when springs are impregnated with a considerable quantity of salts, iron, sulphur, and the like, they are called mineral springs, and many of them have valuable medicinal properties. Hot springs, accompanied by violent jets of steam throwing columns of water to a great height, with a sound like the discharge of artillery, occur in many parts of the globe, and are called jetting springs or geysers; they are due to the unequal heating of a column of water in an open upright shaft passing through hot volcanic ground.

The geysers of Iceland have long been noted, but they are surpassed by the fountains in the Yellowstone Valley, at the Rocky Mountains in Montana Territory, which are said to be one thousand five hundred in number, some of which, as the Giantess, throw columns of water to the height of two hundred feet. "The sound of the Giantess," says a well-known traveller who witnessed it, "was very loud, and was repeated irregularly and rapidly when the water, after heaving several times, suddenly rose in a large column, accompanied by clouds of steam. The column seemed as if it burst, and sinking down it produced a wave which caused the water to overflow the basin in considerable quantity. After the first propulsion the water was thrown up again; there was now a succession of jets to the number of eighteen. Though the wind blew strongly, yet the clouds of vapor were so dense that I could see only the highest part of the spray, and some of it that was occasionally thrown out sideways; then the water suddenly left the basin and sank into the shaft, but soon rose again and the discharges continued, being more frequent and louder than before, and resembling the firing of artillery, raging furiously and throwing up a succession of magnificent jets, the highest of which was about two hundred feet, and the temperature 200°."

MACGILLYCUDDY'S REEKS AND THE UPPER LAKE, KILLARNEY.

LAKES.

A lake is any considerable body of standing water surrounded by land and not directly joined with the sea. Most lakes have one or more streams flowing into and flowing out of them, but sometimes they receive rivers and have no outlet, in which case they are more or less salt. The Caspian Sea is a little less salt than the ocean. The saltest lake known is the Tuz Gul in Asia Minor, which contains thirty-two per cent of saline matter; the Dead Sea has twenty-four per cent, and the Great Salt Lake twenty-two per cent. Having no outflow, the salt of the streams entering these lakes accumulates. Some small lakes have neither visible outlet nor inlet, being fed by springs from the bottom. All lakes gradually fill up; for the streams that enter them deposit sand and mud, and where their margins are marshy the vegetable decay forms a peaty matter which contracts their areas. Some of the most fertile valley lands were once the sites of lakes. Lakes purify the water that enters them, and are objects of great beauty in a landscape. They are useful in detaining for a time the excess of heavy rainfalls, thereby preventing destructive floods. The lakes of Killarney in Ireland are noted for the beauty of their scenery. The muddy St. Lawrence where it issues from Lake Ontario is as pure as the ocean.

The Lake Regions of the Globe. — North America exceeds all the other continents in the number and extent of its lakes. Along the course of the St. Lawrence there is a chain of "fresh-water seas,"— the five great lakes, Superior, Michigan, Huron, Erie, and Ontario, covering an area of ninety-two thousand square miles. They are quite deep, the depth in some places being one thousand feet. The northern part of the continent presents a still greater number of lakes, though not of such vast dimensions. The elevations of lakes vary; for instance, that of the Great Salt Lake is four thousand two hundred feet, while the Caspian is only eighty-one feet.

The following are the dimensions of some of the largest lakes in America, along with a few well-known lakes in other parts of the globe: —

American Lakes.

Name.	Square Miles.
Superior	32,000
Michigan	24,000
Huron	20,000
Erie	9,600
Great Bear	9,300
Ontario	6,300
Winnipeg	8,500
Lake of the Woods	7,650
Athabasca	3,200
Nicaragua	2,830
Great Salt Lake	2,290
Champlain	1,500
George	114

Asiatic Lakes.

Name.	Square Miles.
Caspian Sea	177,000
Aral Sea	26,400
Dead Sea	500

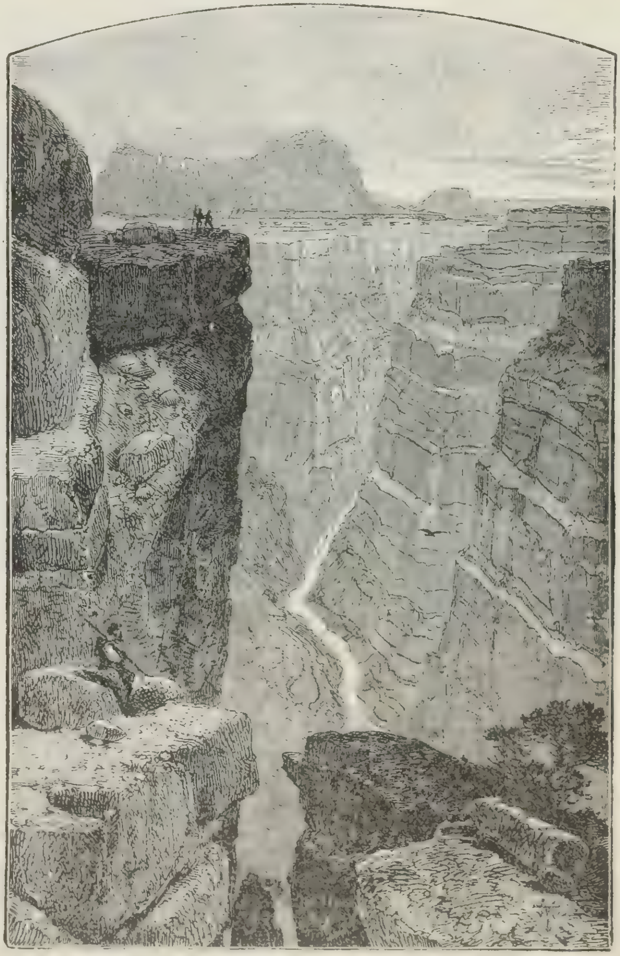
European Lakes.

Name.	Square Miles.
Ladoga, Russia	6,900
Onega, Russia	4,900
Wener, Sweden	2,300
Balaton, Hungary	255
Geneva, Switzerland	220
Maggiore, Italy	70
Como, Italy	59
Killarney, Ireland	20

Effects of Water on the Land. — The famous Greek philosopher Aristotle called water the best of all things.

Almost all cities are situated on rivers. Since the beginning of mechanical contrivances, streams have been employed to turn wheels and drive machinery and aid in manufacturing. Large rivers are highways of conveyance, the Amazon and its tributaries furnishing fifty thousand miles of water communication. Though the most obvious use of rivers is to drain the country through which they flow, they carry off its superfluous waters, and often also its filth, for which, in fact, the soil is the proper receptacle. Rivers do a great deal of work besides turning wheels and carrying steamboats and barges; they are constantly levelling down the higher parts of the land and carrying them gradually to lower levels.

Hardness in so many springs and rivers arises from having an undue proportion of lime, and this is the case with springs that issue from land containing a great deal of limestone and chalk. A common degree of hardness in such waters is twelve grains of limestone (also called carbonate of lime or calcic carbonate) in a gallon. Water containing lime is not unwholesome to drink, but it is bad for washing, and requires to be softened by boiling or other means. Melted snow acts like rain-water, and sinks into the earth. Among high mountains the heat of summer is not sufficient to melt all the snow, and down to a certain level the tops of the mountains are always white; that level is called the snow line.



Grand Cañon of the Colorado.

Soil. — The oxygen of the air rusts some rocks as it does iron; the water slowly dissolves some parts of them: but frost bursts the hardest. When water turns to ice, it enlarges in bulk and often bursts pipes in which it is confined. Now, water sinks into the surface pores of all stones, and when it freezes it pushes the sides of the pores asunder, and after a thaw a thin film peels off the stone. It is this rock powder that forms the chief part of the soil in which plants grow.

Valleys. — Deep and narrow *ravines* bear evident traces of having been worn out by streams running through them In time the ravines are still further widened by the rivers winding and undermining their boundaries, first on one side and then on the other, until they become *valleys*.

Cañons. — Some rivers have cut for themselves deep, narrow channels with straight and upright walls, the water running at the bottom from wall to wall. The river Colorado, which rises in the Rocky Mountains to the south of Great Salt Lake, and falls into the Gulf of California, is remarkable for the number of such gorges, cut both by the main stream and its tributaries in the table-land which they traverse; and it is from the Spanish inhabitants of that region that channels of this kind have got the name *cañons* (Spanish, tubes).

The Grand Cañon of the Colorado is two hundred and forty miles long, and from 2,500 to 4,000 feet deep. The walls are of the hardest rock, and there is little rain and frost to break them down.

Earthquakes. — The earth has its quakings, from the slight tremor, hardly perceptible, to the violent commotion when the ground rocks to and fro like the billows of the sea.

Earthquake at Lisbon.

and the earth opens, and cities are reduced to ruins, and the sea driven with violence over the land. Commotions of the more violent kind are most frequent along certain tracts on the globe, which are known as *earthquake lands*, and are intimately connected with the sites of volcanoes; but probably no large section of the globe is wholly free from earthquakes. Sometimes all that is felt is an indistinct underground rumbling like that of distant thunder, or of a heavily laden wagon; or the motion may be sufficient to make loose objects jingle, or even to be perceptible as a slight shock; and sometimes the shock has been severe enough to overthrow houses, and even huge masses of rock and soil are detached, damming up rivers, forming lakes, and altering the features of the country. Sometimes the ground is rent in great cracks, many miles long and several yards wide, which engulf whatever happens to be on the surface. In consequence of an earthquake under the bed of the ocean, the sea sometimes retreats for hundreds of yards and then returns in huge billows that burst over the land, utterly annihilating entire towns.

The most violent earthquake ever experienced in the Old World was that which destroyed the city of Lisbon in 1755. A hollow thunder-like sound was first heard, and was immediately succeeded by such a violent upheaval of the ground that in three minutes the greater part of the houses were overturned, and 30,000 human beings perished; other shocks followed, and altogether 60,000 lives are estimated to have been lost in Lisbon and its neighborhood. The ocean first retreated and then advanced in a wave fifty or sixty feet high, and its violent flux and reflux extended along the whole coast of the peninsula, and even to the British coasts. This earthquake was felt over a wide area; even in the Scandinavian peninsula the ground was felt to tremble. But most of the agitation was seen on lakes, which, even as far as Ireland, Scandinavia, and Switzerland, were observed to surge up on their banks and retreat,—a phenomenon which continued for an hour or more. Even vessels far out at sea felt the shock so severely that the men were thrown up a foot or more from the deck.

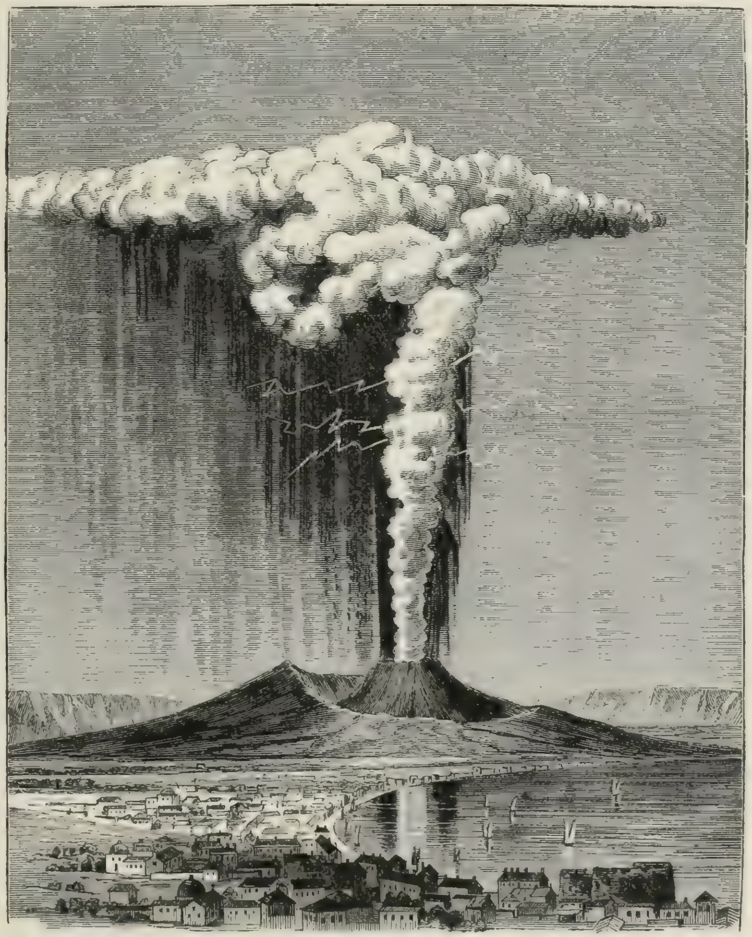
But in widespread ruin and death, probably no earthquake on record has equalled that which devastated Peru and Ecuador in 1868. The convulsion extended over a length of 2,000 miles, reducing many cities and towns to ruins, and burying the inhabitants by thousands. The destruction caused by the sea was enormous, seaports being overwhelmed and shipping utterly wrecked. An American man-of-war was carried a quarter of a mile inland, and lost only one man.

The southeastern districts of North America, along the ranges of the Appalachian or Alleghany Mountains, are liable to frequent earthquakes.

A VOLCANO is a conical mountain composed of matter that has been thrown out from the interior of the earth. In the top is a cup-shaped cavity called the crater; and from this cavity there is an issue of heated vapors or waters, and at intervals dust and stones or streams of molten rock are discharged. Sometimes a mere hole in the ground from which gas and steam rise, or a small mud hill ejecting hot vapors and water, show volcanic action. When a volcano is in a dormant state, the only external sign of activity is a light cloud of white vapor floating over the top. On looking down into the crater, the jets of steam that form the cloud may be seen issuing from numerous points in the flat space at the bottom, also little cones throwing out ashes, and often cavities in which red-hot lava is in a boiling state. But every now and then, at quite irregular intervals, the state of comparative quiet is interrupted by an outburst of violent activity.

Our drawing of Vesuvius in eruption will give an idea of the outburst. The molten lava is highly charged with fluids which continually escape from its surface with violent explosions, and rise in light round clouds to a certain height, after which they spread into a dark cloud, from which showers of rain are frequently discharged; a mass of ashes and pieces of the rocks forming the walls of the crater are also shot upwards, and fall down in showers outside, or back into the crater, from which they are again and again ejected. Forked lightning often accompanies an eruption, and is caused by the friction in the air of the ejected stones, which are reduced first to coarse gravel, then to sand, and lastly to fine dust.

LAVA STREAMS. — Lava issues from the crater white hot and flows like melted iron; but the surface soon darkens, hardens, and cracks into fragments like huge black cinders before long the surface is firm enough to walk upon, while the mass below is still fluid. The lava stream occasionally continues in slow motion for months after the eruption has ceased. The mass of matter ejected is sometimes enormous. Some lava streams are several miles long and several hundred feet thick.



VESUVIUS IN ERUPTION

VOLCANIC ASH. — The fine ashes thrown out during eruptions are sometimes carried by an upper current of air a distance of several hundred miles.

Volcanic Steam. —The steam that issues from a volcano, becoming cooled in the air, condenses and falls in torrents of rain; this, mingling with the falling and fallen ashes, descends the slopes in streams of mud. It was such mud-lava from Vesuvius in 79 A. D. that overwhelmed the cities of Herculaneum and Pompeii.

Bands of Volcanoes. —There are about four hundred active volcanoes in the world, mostly arranged in bands, and as a rule not far from the sea. The Pacific Ocean is bounded by an almost unbroken line of active volcanoes. Two thirds of the active volcanoes are on islands; Java has forty-five of them, twenty-eight of which have been seen in eruption. The most noted earthquake district in the New World lies along the coast on the west side of the Andes and near the northern mountains of Venezuela; in the Old World, along the Mediterranean, in Central Asia, and from Iceland along the northwestern part of Europe.

Causes of Earthquakes and Volcanoes. —Both are closely connected, and occur not only in the same region, but also at the same time; hence both have the same cause. A growing belief among geologists (see Geology) is that the chief cause of volcanic eruptions and earthquakes is the force of steam. The crust of the earth, though upon the whole solid, is believed to contain caverns and lakes of molten rock, and volcanoes are pipes of communication between them and the surface. Into these lakes water, sinking down through crevices from the ocean or the land, must be constantly finding its way; and the steam thus produced has such enormous pressure as to force the molten rock to the surface, itself mingling and escaping along with it during the eruptions. Owing to the constant shrinking and cracking of the earth crust, masses of water must frequently fall suddenly into these hot caverns and lakes, and the explosion of steam will produce shocks, and where there is no vent, may be sufficient to convulse and rend the ground above. Another cause of earthquakes has been suggested in the falling of large rock masses from the roofs of caves in the interior of the globe, or in the cracking of the rocky ground when crushed while the earth is shrinking.

Extinct Volcanoes. —Almost every region on the globe bears marks of former volcanoes which are now extinct. During the changes on our planet eruptions died out at one place and broke out at another. In some places, as in Auvergne in France, there are yet to be seen craters and descending currents of lava as perfect and fresh as if the eruptions had taken place a few years ago; in other places, as in the British Islands, the waste of elements left no trace of a crater. There is evidence that a chain of volcanic islands extended from the North of Ireland to Iceland, and formed the hills of Antrim and the islands of Mull, Eig, Skye, Faroe, and the older parts of Iceland. The present active volcanoes of Iceland are probably a remnant of this band.

THE ATMOSPHERE.

Over the solid earth and the liquid seas lies an ocean of air, in which we and all things on the earth's surface are immersed. This air envelope of our globe is called atmosphere (from Greek *ἀτμός*, vapor, and *σφαῖρα*, a globe). In our chapters on Astronomy and Physics we have explained the nature and phenomena of the atmosphere, and will here make some additional remarks on the subject.

Weight and Height of the Atmosphere. —The atmosphere presses on us with great weight, —as much as fifteen pounds on every square inch of surface, —but as it presses equally on all sides, and upward as well as downward, we do not feel it; but when the air itself moves, we feel it as wind. The atmosphere extends, it is believed, to a height of about

200 miles. Air is a very elastic substance; that is, it can be forced into less bulk by squeezing, and it is ready to start back to its former size when set free; the lower portions of air near the earth's surface are therefore much heavier than the upper portions, being pressed together by the weight of what is above, just as the under layers of a high heap of cotton would be heavier than those on top. For instance, a cubic foot of air on the top of Mount Brown in the Rocky Mountains, about three miles above the level of the sea, weighs only one half that of what the same quantity weighs on the sea level.

Composition of the Air. — Air is not a simple substance: it consists of several gases, mostly nitrogen and oxygen, with nearly four parts of the former to one of the latter. Oxygen is the vital part of the air in breathing, and it makes a fire burn. Nitrogen seems to serve for diluting the oxygen. There is also *carbonic acid* in the air.

When coal, wood, or something else is burned, the carbon of the fuel — which is a black, solid substance — unites with the oxygen of the air, and carbonic acid is formed. It is formed also in breathing. The oxygen we take into our lungs unites with the carbon of the waste parts of the blood, and burns up, as it were; and our breath comes out charged with carbonic acid instead of oxygen. Carbonic acid is as invisible as air, and is very poisonous.

Air, in its natural condition, contains only one part carbonic acid in twenty-four hundred of bulk, and when thus diluted does no harm; but when the proportion rises to one part in three hundred and thirty it becomes very hurtful. This takes place when people live in close rooms and breathe the same air over and over again; and hence the necessity of ventilation.

How the Air is purified. — The leaves of all plants draw in the carbonic acid from the air around them, when the carbon is separated and retained to build up the plant, while the oxygen is again given out to the air.

Ammonia is the gas we smell when feathers or wool are burned, a very small quantity of which is in the air. It is part of the food of all plants, without which they cannot grow; and since plants form the food of animals, it thus appears that the atmosphere is the great storehouse of sustenance for both plants and animals.

Vapor is always present in the air, and it produces great effects both in the sky and on the earth; but its quantity varies greatly. True vapor or steam — for the two things are the same — is as invisible as air. Steam issuing from a teakettle is, close to the mouth of the spout, clear; the white cloud that begins a little from the mouth does not consist of vapor, but of very small drops of water, — some of the steam, by uniting with the colder air, having turned again into water. Clouds and fog are water dust, and not water in the state of gas or vapor. When the air is very clear and distant objects are plainly visible, there is very often a large quantity of moisture in the atmosphere.

Condensation. — When air is suddenly cooled, it has less capacity to hold vapor, or dissolved water, and it gets rid of it again by throwing down from the form of a gas into the original form of water a part of what it had dissolved. This process is called condensation.

Evaporation. — From seas, lakes, rivers, and from all bodies containing moisture water is continually rising into and dissolving in the air; and this is what is meant b evaporation.

The cooling Effect of Evaporation. — A great deal of heat disappears or becomes laten (concealed or hid) when water turns to vapor. The vapor is not any warmer, either to th feeling or to the thermometer, than the water or the air; and yet it has absorbed a great deal o heat. If we wet the back of our hand and expose it to the air, we feel that the drying up of the water is robbing the skin of its warmth, especially if the hand is moved through the air. Rain cools the air in sultry weather, not so much while falling as by the evaporation that follows. It is dangerous to allow wet clothes to dry on the body, for the loss of the heat carried off in the vapor causes a chill.

Capacity of Air for Vapor. — As a sponge can hold only a certain amount of water, so air can hold only a certain proportion of vapor; the warmer the air is, the greater is its capacity for vapor. Air that contains little vapor is dry, and absorbs moisture greedily from everything that contains it.

WINDS.

Velocity of Wind. — Wind is air in motion. What is called *gentle air* moves at the rate of six or seven miles an hour; fourteen miles makes a *light breeze;* forty miles, a *gale;* sixty miles, a *heavy storm;* eighty or one hundred miles, or upwards, a *hurricane.*

The force of the wind may be measured by exposing a thin plate, a square foot in size, with its face toward the wind, and marking how much the plate presses against a spring. A velocity of ten miles an hour is estimated to give a pressure of half a pound; of twenty miles, two pounds; of forty miles, eight pounds; of eighty miles, thirty-two pounds; of one hundred miles, fifty pounds, a force sufficient to blow down walls.

The Cause of Winds is the unequal distribution of pressure in the atmosphere, and this again is caused chiefly by the unequal distribution of heat and vapor. When a fire is burning in a grate, the air about it becomes heated; this causes it to expand, and being now lighter than the air around it, it floats up the chimney, and a draught or current of fresh air sets toward the fireplace, to fill the space that is made vacant: in the same way all winds originate.

The air in nature is *unequally* heated, because all parts of the earth's surface do not receive an equal share of the sun's rays. We explained elsewhere why the sun's rays produce much less effect in winter, coming in a slanting direction, than in summer, when they fall in an almost upright line. Within the tropics they fall nearly straight all the year round; this region is called the *torrid zone*, and receives a far larger share of heat than the other parts of the earth.

How Air is heated. — It is not heated directly by the sun's rays. Air, especially when dry, allows the sun's heat to pass through, along with the rays of light, its temperature remaining unchanged; but when the rays of the sun strike the surface of the globe, that surface absorbs them and becomes heated, and by touching this heated surface the air gets its share of the warmth of the sun.

Air Currents from the Poles to the Equator and back again. — The air that lies over the torrid zone, becoming heated by touching the warm surface, ascends, and currents of cooler air from the regions northward and southward rush in to take its place, while at the same time the heated air, rising above the general level of the atmosphere, passes over as warm currents toward the poles.

Trade-Winds are the polar air currents from the northeast and southeast blowing around the equator; and are so constant that they can be calculated on by navigators.

Sea and Land Breezes. — If the sun shines with the same force on two spaces, the one water and the other land, the land will soon be heated, and at the end of the day it will be found warmer than the water; but at the end of the night it will not be so warm as the water. When the land is hottest, the air resting upon it will be hotter and lighter than the air over the sea, and the cold air from the sea will rush in to supply the place of the hot air which ascended; therefore, during the day there will be a breeze from the sea to the land, and during the night a breeze from the land to the sea.

MONSOONS are winds blowing off the coasts of India and China; during the winter they are from northeast, and in summer from southeast.

SIROCCO is a hot, parching wind from the desert, blowing over Palestine, Sicily, the South of Italy, and Spain.

STORMS are sudden and violent winds; they resemble whirlwinds, only that the whirl often extends over hundreds of miles. The currents of air in whirlwinds move in circles round a centre where there is a calm, and hence such storms are called *cyclones*, or great circles. Their origin is thus expiained: In the centre of the whirl there is always a low barometer, showing a diminished pressure of the atmosphere, caused mostly by heat, and followed by an ascending current. Toward this area of low pressure currents set in from all quarters in an oval direction round that centre.

HOW TO KNOW IN WHAT DIRECTION THE CENTRE OF A STORM LIES. — The rule is this: Wherever you are, stand with your back to the wind, and then the centre is towards the left in the northern hemisphere, and to the right in the southern hemisphere. A knowledge of this is important to mariners, as it shows how to steer so as to get out of the cyclone Tornadoes act like cyclones, only on a smaller space. In passing over deserts the tornadoes lift up loose sand, and in passing into the sea they lift up columns of water which whirl in the air and are called water-spouts. In the United States six hundred tornadoes have occurred in the last eighty-seven years. Kansas is the State which has been most severely affected by them, having been visited by sixty-two in the period from 1859 to 1881; and the West was visited by two quite destructive tornadoes in 1882. In the Chinese seas cyclones are known as typhoons.

In treating physics, we have spoken of humidity, dew, rain, snow, hail, fog, climate, temperature, etc., and will add here some remarks on the last-named two subjects.

CLIMATE.

The climate of a country is its condition as to warmth, moisture, wind, and the like, — its character, in short, as to weather. The first thing to be considered in weather is the temperature, or amount of heat and cold; and in estimating the temperature of a place it is necessary to take account both of the mean temperature and of the extremes.

TEMPERATURE.

By the mean temperature of a place is understood the average temperature, or the mean of the greatest and least temperatures for a whole year, or for a number of years.

CAUSES AFFECTING TEMPERATURE. — The temperature of any particular part of the surface of the earth depends mainly upon two things: (1) its latitude or distance from the equator; and (2) its elevation above the sea.

While latitude locates the position of places on the earth's surface so far as their distance north or south of the equator is concerned, longitude in connection with latitude determines the exact position of a place with respect to any other place.

Latitude is reckoned north and south from the equator to the poles; and longitude is reckoned east and west from an imaginary agreed-upon line called a meridian, extending from one pole to the other. The meridian selected for reference in this country passes through the city of Washington, D. C.; but other countries reckon either from the meridian which passes through the capital city of their own country, or that which passes through Greenwich, England. Our maps usually give the longitude reckoned both from Greenwich and Washington.

By means of longitude, the difference of time between places is determined; for rules of finding which, see Arithmetic.

The following table shows the real time at different cities of the world when it is 12 M. at Washington, D. C.

Albany, N. Y., 12.13 p. m.
Berlin, Germany, 6.02 p. m.
Boston, Mass., 12.24 p. m.
Cape Town, Africa, 6.22 p.m.
Canton, China, 12.41 a. m.
Charleston, S.C., 11.48 a. m.
Chicago, Ill., 11.17 a. m.
Cleveland, Ohio, 11.41 a. m.
Denver, Col., 10.08 a. m.
Dublin, Ireland, 4.43 p. m.

Galveston, Texas, 10.49 a. m.
Halifax, N.S., 12.54 p. m.
Indianapolis, Ind., 11.24 a. m.
London, England, 5.08 p. m.
Melbourne, Aus., 2.48 a. m.
Moscow, Russia, 7.38 p. m.
New Orleans, La., 11.08 a. m.
New York, N. Y., 12.12 p. m.
Paris, France, 5.17 p. m.
Philadelphia, Pa., 12.07 p. m.

Providence, R.I., 12.22 p. m.
Richmond, Va., 11.58 a. m.
Rio Janeiro, Brazil, 2.15 p.m.
Rome, Italy, 5.58 p.m.
St. Louis, Mo., 11.07 a.m.
Salt L. City, U. T., 9.40 a.m.
San Francisco, Cal., 8.58 a. m.
Toronto, Ont., 11.51 a. m.
Vienna, Austria, 6.14 p. m.
Wheeling, W. Va., 11.45 a. m.

STANDARD TIME. — For years accurate local time has hardly been known, for nearly all the travelling public has kept the railroad time used in its own section; but, owing to the short extent of most railroads, the standards of time have been many. To obviate this inconvenience, our railroad managers and town authorities agreed to reduce the number of divisions of standard time, in this country, to five; each occupying territorial space, east and west, exactly equal to 15 degrees of longitude. (See Arithmetic, pages 22 and 28, for difference in degrees of longitude, and to find real difference of time.)

The meridian which passes through Greenwich, England, was selected as the centre of the first division of the globe. Just four divisions of 15 degrees each, reckoned west from Greenwich, brings us to the 60th degree of longitude, which is the centre of the first division in America. The centres of the other American divisions will therefore be, in order, as we go west, the 75th, 90th, 105th, and 120th meridians. All places within 7½ degrees on either side of each centre will have the same time as that centre, and each division as we go west will have time one hour earlier than the division east of it; that is, when it is 12 o'clock M. at all places in the most eastern division of America (between 52° 30′ and 67° 30′ west longitude), called the *Intercolonial* (or all in America east of Eastport, Maine), it will be 11 o'clock A. M. in the next division west (between 67° 30′ and 82° 30′ W. L.), called the *Eastern;* 10 A. M. in the one west of that (between 82° 30′ and 97° 30′ W. L.), called the *Central;* 9 A. M. in the next (between 97° 30′ and 112° 30′ W. L.), called the *Mountain;* and 8 A. M. in the most western division in America, called the *Pacific.* This arrangement of time went into operation at noon, Nov. 18, 1883.

EFFECTS OF LATITUDE ON TEMPERATURE. — The reason why the sun heats the equator and the regions adjoining more strongly than it heats the temperate and polar regions is, that at the equator it rises higher in the heavens and shines more directly downward. This, and the difference between slanting and direct rays, have been explained elsewhere. The mean temperature of the equator is about 80°. If the whole earth were a perfectly smooth globe of one uniform kind of surface, — that is, if it were all sea, or all one kind of level land, — the temperature would decrease steadily from the equatorial amount, according to the latitude; but the variations of the surface cause many deviations.

Effects of Elevation on Temperature. — In ascending a mountain or going up in a balloon, the thermometer, as a rule, falls about one degree for every three hundred feet. This increase of cold is explained by what we said about atmospheric warmth. The heat rays of the sun pass through the air as light does through glass, and warm the solid earth, which then warms the air by contact; first the layers of the air next to the surface of the earth, which being denser absorb more warmth, and then the upper layers, which grow thinner and colder the higher they are. A column of heated air arising from the plains at the temperature of eighty degrees is soon at the freezing point.

Travellers ascending a lofty mountain in the tropics experience all the varieties of climate, from that of the torrid zone at the foot, through all the grades of temperate up to the frozen, in the same way as if they had travelled from the equator to the arctic circle. The temperature of a country is often different from what it should be according to its latitude, not only on account of its elevation, but also on account of prevailing winds and its inland or insular position. Winds bring with them the temperature of the regions they have crossed; hence a wind coming from the tropics is a warm wind, a polar current cold: though winds arriving from the ocean are not subject to such changes during the year as winds from the continent. The temperature of water being more equable than that of land, an insular country has not the extremes of heat and cold that an inland country has. The direction of mountain ranges gives a region a higher temperature in protecting it from the cold blasts of the north; hence its climate is milder than that of shelterless plains in the same latitude.

Range of Temperature. — The mean temperature of a place is of less importance than the difference between the temperature of the hottest month and that of the coldest. The severity of the strain of extreme climates on man's system is shown by the rapidly increasing death-rate as the difference between the July and January temperatures increases. It is as hot in Moscow in summer as it is in Naples, though there is a great disparity in the winter temperature. The difference is mainly owing to the insular position of the latter. Ireland and Labrador in the same latitude have different temperatures, Labrador being much colder than Ireland.

MOISTURE.

Causes of Moisture. — Several circumstances go to determine whether a climate should be moist or dry. Nearness to the ocean or to large lakes, an ill-drained or wet soil and rank vegetation, tend to keep the air over a place moist; but the direction of the prevailing winds is the most important consideration. If they come over a tract of warm sea, they will naturally be laden with moisture; if they come over land, especially if they start from the polar regions, where the air is deprived of nearly all its moisture by cold, they will be necessarily dry, as is the case with our northeast winds.

Rainfall. — The rainfall is of course greatest in tropical countries, where the high temperature of the air enables it to contain a great deal of vapor. When such air is cooled, the rain descends in torrents. The cooling is caused by the mixing of cold and warm currents. The average rainfall at the equator is ninety-five inches, and it decreases towards the poles; in Finland it is only fifteen. The average rainfall of temperate America is thirty-eight inches, and of Eastern North America forty inches.

Number of Days on which Rain falls. — In tropical countries there are one or two rainy seasons, the rest of the year being dry, and in temperate regions the rain is more evenly spread over the year. The equatorial rainfall of ninety-five inches is confined to about eighty days; in London rain falls on an average one hundred and seventy-eight days in the year, although the whole amount is only twenty-one inches.

In speaking of the phenomena of the atmosphere, we have to mention

THE WEATHER.

A remark about the weather habitually forms the burden of our friendly greetings, and the wish and the hope of a fine day are no trivial matters in our climate; but if we are interested in the present weather, we are often far more so in regard to that which is to come. The subject comes home to us all. It is material to the man of business; it is a serious consideration to the mariner on the deep; and it is vital to the farmer. Those who are most concerned about approaching changes of the weather, who are going to sea, or on a journey, or a mere excursion, those who have agriculture, gardening, or other out-door pursuits in view, may often get useful cautionary notices from those published expectations of weather in the newspapers. Some persons have impugned the accuracy of these forecasts, questioned their principles, or demurred to their having any claim to a really scientific basis.

The weather forecasts depend on considering the atmosphere as a lighter ocean, having currents, elastic expansibility, chemical alterations, and finally, extreme sensibility to heat and cold, which cause its principal changes. Now, by knowing the pressure of the atmosphere at several places simultaneously, and again similarly after certain intervals of time, comparisons can be made which may show existing causes of certain effects. By thus estimating the atmospheric area above, around, and within thousands of miles of us by barometric observations at the same hour, and by summary calculations of the progression of the wind, all the principal movements and changes are brought within the grasp of forecast. The storm travels usually at the rate of a carrier pigeon, — that is, sixty miles per hour, — while electricity wings its way after the manner of light itself as it comes to us from the sun; therefore the information, received by telegraph, of a cyclone actually in progress at a great distance, and working its way toward a certain locality, can be announced by the American Signal Office, throughout the length and breadth of the United States, from twelve to twenty hours before the storm could be felt. Since the establishment of said office, and through its work, meteorological science has greatly advanced. Sixty-four important cities, through their boards of trade, marine insurance companies, and merchants, have petitioned Congress in behalf of "A bill to increase the efficiency of the signal service." In April, 1882, a petition came from Boston, bearing the names of one hundred and thirty-nine of the most prominent business men in the city, asking for the passage of the bill.

Work of the United States Signal Office. — The record shows that from eighty-five to eighty-nine per cent of the weather predictions of the office are verified. This means a great saving of life and property. Since the establishment of the system of cautionary signals on the great American lakes, the annual loss of vessel property has decreased from $2,586,781 to less than $500,000, and the loss per ton from $3.63 to 76 cents. The predictions of coming frosts in the sugar-growing States, and in the cotton region of the United States, of coming "northers" for the stock-raisers of Texas, have been verified so often that they are trusted almost implicitly. The fact is that the weather service has made so important a change in the conditions of carrying on agriculture, that the farmer who does not follow its predictions cannot compete with one who does. It is due also to the American Signal Office that there is an organized international service, which makes possible a complete series of observations throughout the world. One of the first meteorologists of modern times, the late Admiral Fitzroy, said: "Every prudent person will combine observation of the elements with such indications as he may obtain from instruments, and will find that the more accurately the two sources of foreknowledge are compared and combined, the more satisfactory their results will prove." From many observations we derive the following

PRACTICAL WEATHER RULES. — If the wind shifts from south to north through west, the barometer rises and the thermometer falls. Thereupon, in winter there will be heavy falls of snow, in spring sleet showers, and in summer thunder-storms, after which the air becomes much cooler.

If the wind veers from north to northeast, we have clear weather, the air is dry, the barometer high, and in winter intense cold follows, with great clearness of the atmosphere. As soon as the barometer begins to fall, the wind gets round to east; the sky, previously deep blue, covers itself with thin whitish clouds, and with the snow which falls comes the south wind. If the glass falls rapidly, the snow turns to rain, and a thaw sets in when the wind veers farther through southeast and south to southwest.

The change from a clear sky to an overcast one usually commences with the appearance of fine, streaky *cirrus* clouds, which gradually change to *cirro-stratus*, and the uniform coating of cloud is complete. This cirrus indicates the equatorial current seen from beneath, which has already set in above, and marks its progress by the streaks of cloud. The water, on its condensation from the state of vapor, assumes the solid form at once; so that these high clouds are not composed of vapor, but of minute particles of ice, and they give rise to the halos of the sun and the moon, which are caused by refraction of the light. If these appearances accompany a falling barometer, it is a sure sign that wet weather is coming on.

If easterly and northerly winds have lasted for a long time in summer, with very dry weather, and moist wind sets in, the vapor condenses itself at once on the dust which is in the air, and the latter thus becomes heavy and sinks to the ground. Under these circumstances the air becomes very clear, and in mountainous countries the mountains appear quite close, and the waterfalls and railway whistles are heard more distinctly. This is considered an infallible sign of rain.

Rain comes, as a general rule, from the west side; so that a clear sunset is a proof that there is no rain coming from that quarter for some time. Hence this is a sign of fine weather.

There is an old French proverb —

> "Temps qui se fait beau la nuit,
> Dure peu quand le jour luit."

"If the weather clears up at night, it will not last when the day breaks."

The reason is that when, in the evening, the air ceases to ascend, the clouds sink and are dissolved or vanish in the warm strata below; but the moisture is still there, so the fine night is deceptive, and it will probably rain in the morning.

SULTRINESS, or the oppressive feeling we sometimes experience, shows that the atmosphere is very damp; it is already saturated with vapor, and therefore the evaporation from our bodies is checked: hence the oppressive feeling. The direct action of the sun is then more felt, and we say the sun is scorching. The fault is in the air, which cannot rid us of our superabundant heat, because it is already abundantly provided with heat and moisture. By fanning we manage to bring cooler portions of the hot air to our radiating surface, and so get a temporary relief.

Sudden rains never last long; but when the air grows thick by degrees, and the sun, moon, and stars shine dimmer, it is likely to rain for a few hours.

The dimness of the stars and other heavenly bodies is one of the surest signs of very rainy weather.

When the stars look bigger than usual, and pale and dull and without rays, this undoubtedly indicates that the clouds are condensing into rain, which will very soon fall.

If it begins to rain an hour or two before sunrise, it is likely to be fair before noon, and so continue all day; but if the rain begins an hour or two after sunrise, it is likely to rain all day, except the rainbow be seen before it rains. The rainbow is caused by the refraction and reflection of the sun's rays in the drops of falling rain at the spot where it appears; the spectator has the sun behind him, and the clouds with the bow in them before him. The colors are arranged as follows: Violet, purple, blue, green, yellow, orange, red. If the green be large and bright, it is a sign of rain; if the red be the strongest color, then there will be wind and rain together.

After a long drought, the rainbow is a sign of rain; after much wet, it indicates fair weather; and if the rainbow breaks up all at once, there will follow serene and settled weather.

Numerous signs of the weather may be gathered from the observation of the *clouds.*

If small clouds increase, expect much rain. The increase must be caused by a cold current of wind passing over, and when the wind drops the mass of vapor will fall as rain. Small inky-looking clouds foretell rain.

If large clouds decrease, expect fair weather. A warm wind is passing above absorbing them apace.

If the *cirri* form during fine weather, with a falling barometer, it is almost sure to rain.

The *cumuli* form during fine weather, and indicate its continuance when they are like huge sugar-loaves. If they are fleecy and sail against the wind, they indicate rain, but when their outline is very hard and they come up *with* the wind, they foretell fine weather. If cumuli get smaller toward evening than they are at noon, expect fair weather; if they increase in size at sunset, expect a thunder-storm at night.

We see sometimes in the evening the *stratus*, nearer the earth than any other cloud. Should it disappear in the morning, expect the finest weather.

The *cirro-stratus* invariably indicates wind and rain.

The *cirro-cumulus*, when permanent, is a sign of increasing temperature and fine weather.

The *cumulo-stratus* not only portends a change of weather, either from fine to rain or from rain to fine, but rain and thunder in warm weather, and snow-storms in cold weather.

The *nimbus* is the true and immediate rain-cloud.

According to Dr. Herschel, *anvil-shaped* clouds are very likely to be speedily followed by a gale of wind.

All those alterations in the atmosphere which indicate a change of weather are less observed by men than by animals; as it is only when we happen to have an old healed wound or are subject to rheumatism that we become animated barometers, and feel the coming weather in sundry twitches and aches.

WEATHER SIGNS FROM ANIMALS.

Animals feel by instinct a change of weather. Thus, when rain is coming, swallows chatter, cats "wash their faces," small birds prune themselves, and crows make a great noise in the evening. The reason is because these creatures love wet weather and rejoice at the approach of it. Dogs and cats feel lazy and drowsy at the approach of rain; because the air is deficient in oxygen, and the damp depresses the nervous system. At the approach of rain, cats turn their backs to the fire and rub their ears; because the air, then being surcharged with electricity, gets between their hair, which is very electrical and gets ruffled and erect, and the cat, being a tidy creature, rubs it to keep it down and smooth. When birds of long flight—rooks, swallows, and others—fly up and down low, then rain and wind may be expected; because the insects which they pursue have taken refuge from the cold upper regions of the air, where the change is beginning, in the warmer air near the earth: the birds then fly low because their food is low.

Insects, also, are very sensible of changes of weather. The surest sign of rain is given by bees: as soon as rain impends, they either remain in their hives or fly out only to a short distance.

Even inanimate creation shows signs of coming wet. Just before rain, flowers smell stronger; because the vapor of the air prevents the scented particles of their perfume from ascending, as they would in drier air.

DISTRIBUTION OF PLANTS AND ANIMALS.

All the native plants of a country or region, taken together, are called the *flora* of that country or region; and the native animals are their *fauna* (from the Fauns, Roman deities supposed to protect flocks and herds). The farther apart countries are, especially north or south of the equator, the more they differ in climate and the more diverse do the flora and fauna become.

Distribution of Plants as determined by Climate—Level Zones.—A common division of the surface of the globe is into eight zones of vegetation, bounded not by parallels of latitude, but by isothermal lines (Greek ἴσος, equal; θέρμη, heat) of mean temperature.

1. *The Equatorial Zone of Palms and Bananas*, extending 15° on both sides of the equator, having a mean annual temperature of 78° to 82°. This zone is distinguished by the luxuriance and variety of its vegetation. Its principal plants are bamboos, bananas, bread-fruit trees, and palms.

2. *The Tropical Zone of Tree-Ferns and Figs*, reaching from the fifteenth degree of latitude on each side of the equator to the twenty-third, having a mean annual temperature of 73° to 78°. The principal plants of this zone are tree-ferns and various kinds of figs. Besides many equatorial plants are found cinnamon, coffee, cotton, indigo, pepper shrubs, pineapples, sugar-canes, and woods valuable for furniture and for dyeing.

3. *The Sub-Tropical Zone of Laurels and Myrtles*, extending from the tropics to latitude 34°, having a mean annual temperature of 62° to 71°.

4. *The Warm Temperate Zone of Evergreens*, from latitude 34° to 45°, with a mean annual temperature of 53° to 62°. This has been called "the region of evergreen trees," and embraces, in addition to many sub-tropical plants, oaks, chestnuts, figs, olives, oranges, pomegranates, and the vine; wheat being the chief grain.

5. *The Cold Temperate Zone of Deciduous Trees* (or those which cast their leaves in winter), between the parallels of 45° and 58°, the mean annual temperature being 42° to 53°. The common grains and trees seen in the northern part of the United States of America form the vegetation of this zone. It is the limit of cultivation of wheat in the northern hemisphere.

6. *The Sub-Arctic Zone of Coniferous* (or cone-bearing) *Trees*, extending from latitude 58° to the polar circle (66½°), with a mean annual temperature of 39° to 42°. In this zone the turnip and potato succeed, but barley does not always ripen; there are also forests of

pine, larch spruce, poplar, and birch. In the southern hemisphere, this zone contains only a few barren islands.

7. *The Zone of the Rhododendrons in the New World and of the Birch and Pine in the Old*, extending from the polar circle to latitude 72°, the mean annual temperature being 28° to 32°. This zone produces in the American part of it rhododendrons; and elsewhere the birch, the pine, the fir, grasses, lichens, and mosses.

8. *The Polar Zone of Lichens and Mosses*, beyond latitude 72°, with a mean annual temperature in the New World of 1° 4′, and in the Old of 16° 7′. In this zone there are neither trees nor bushes, and no plants for food.

UPRIGHT ZONES OF VEGETATION. — Without change of latitude, a succession of zones, corresponding to those above described, occur as we ascend above the level of the sea. Around the base of a mountain in the torrid zone we find the region of palms, extending to a height of 3,000 to 4,000 feet, where the temperature is about 75°. Above this region lies that of the tree-ferns and figs, extending to about 5,000 feet, with an average temperature of 66°. The vine ends at an altitude of 7,000 feet. Above this latter the region of ordinary trees succeeds, and this is followed by the regions of shrubs, grasses, and lichens; the latter merging into the line of perpetual snow, at a height of 15,000 to 16,000 feet.

DISTRIBUTION OF ANIMALS AS DETERMINED BY CLIMATE.

The faunas of the three chief zones are the following:—

1. TROPICAL FAUNA. — The tropical regions are distinguished in all continents by the immense variety of animals which they contain. The principal of these are apes and monkeys, naturally associated with the distribution of palms and other tropical plants, which furnish the greater part of their food; the larger mammalia, such as the elephant, rhinoceros, hippopotamus or river-horse, and tapir; the whole family of toothless animals, as the sloth, ant-eater, etc.; the largest of the cat tribe, as the lion, tiger, and leopard; and the hyena. The tropical birds are generally remarkable for the brilliancy and variety of their plumage, as exemplified by the peacock, flamingo, ostrich, humming-birds, parrots, and the toucan, remarkable for the size of its bill. The largest reptiles, as the crocodile, tortoise, etc., and the most venomous serpents, belong to this zone, as well as the most gorgeous insects, while its marine fauna are superior in beauty and number to those of other regions.

2. TEMPERATE FAUNA. — The temperate zone, included within the isotherms of 32° and 74°, on both sides of the tropical zone, is inhabited by the bear, wolf, fox, weasel, marten, otter, lynx, horse, ass, boar, various kinds of deer, goat, sheep, ox, hare, squirrel, rat, etc.; and in the south by a few representatives of the tropical zone. Among the birds of this zone are the eagle, falcon, turkey, goose, grouse, pheasant, etc. Its reptiles and insects are fewer, smaller, and less brilliantly colored than those in tropical regions.

3. ARCTIC FAUNA. — The arctic zone includes all the animals that live beyond the line where forests cease and are succeeded by vast barren plains. The larger animals are the white bear, walrus, numerous kinds of seal, reindeer, musk-ox, narwhal or sea-unicorn, and whales in abundance; among the smaller are the white fox, polar hare, and lemming. Of birds, marine eagles and a few wading birds are found; and web-footed aquatic birds, as the gannet, cormorant, penguin, petrel, duck, goose, and gull, abound in profusion. Reptiles are unknown in this zone, but fishes are very numerous.

Facts of Distribution not accounted for by Climate or Soil. — In several separate regions, where the climate and other physical conditions are the same, the flora and fauna are often quite different. Thus the cactaceæ are exclusively American. The elephant is found only in Africa and India, each region having its own kind; the ostrich and giraffe in the wilds of Africa, and the kangaroo in Australia. Similar instances occur in the ocean. A particular kind of whale is found only in the Greenland seas; and the cod has inhabited the same banks and shoals for ages. But while particular kinds are thus wanting in some regions, their place is often taken by others so similar to them as to represent them, as it were.

Representative Kinds. — Although the tiger is not found in the New World, its place is supplied by the jaguar; an animal which, though differing according to zoölogy, is so much of the same appearance and habits that the early colonists called it the tiger. Similarly the puma is known as the American lion. In the flora we may instance as representative kinds the cactaceæ or cacti of South America and the euphorbiaceæ of Africa. These two widely separated groups of plants exhibit the relationship of representative kinds.

DISTRIBUTION OF MARINE LIFE.

The waters of the ocean and the ocean bed have their flora and fauna, little less abundant and varied than the dry land; and the life of the ocean is arranged in zones according to

Submarine Life in the Northern Seas.

depth, but the facts so far collected warrant no reliable system. Multitudes of plants and other living creatures, hitherto unknown, have recently been brought up from a depth of five miles, and even greater depths explored are not destitute of life. The distribution of this wonderful marine life is evidently determined mainly by the temperature and direction of the local currents.

DISTRIBUTION OF MAN.

Man is an inhabitant of every country and of every climate; he can live under extreme degrees both of heat and cold; he can subsist on a greater variety of food than any of the lower animals; and his powers of locomotion and contrivance have enabled him to overleap all those barriers that limit other living beings each to a particular region. But man is not the same creature in every part of the globe. The native inhabitant of one region often differs in a marked degree from the inhabitant of another region in color, figure, and many other respects.

The generally recognized divisions of mankind into races, and those which present the least difficulty in arrangement, are based upon the color of the skin, and are known as the Caucasian, or White Race; Mongolian, or Yellow Race; Malay, or Brown Race; Negro, or Black Race; and American, or Red Race. But every division is arbitrary, no matter what its basis, and while in certain localities the peculiar character of each division is very marked, in other regions the gradation and evident blending of race characteristics renders it more difficult to assign these people to their true division than it is to determine where red ends and yellow begins in the solar spectrum.

Making the color of the skin the basis of classification serves the purpose better than any of the other bases (as the form of the skull, or the convolutions of the brain), because the former can be more generally and easily determined; and it is quite as well in every respect, since ethnologists now generally recognize one origin for all mankind, and attribute all differences to climate, location, and habits of life.

It may be said, generally, that the White race is characterized by the oval shape of the head, it being neither very broad nor very narrow; by the nose having a high bridge; by the lips being comparatively thin; and by the languages having a highly developed structure. It includes the native peoples of Africa north of the Soudan; *i. e.*, the descendants of the ancient Egyptians, Numidians, Libyans, and Moors, the peoples of Eastern Asia (Hebrews, Assyrians, Persians, Circassians, Arameans, and Arabs), and all the peoples of Europe except the Turks.

The Yellow race is marked by a broad, low skull, prominent cheek-bones, obliquely set eyes, almost entire want of hair upon the body, with the hair of the head cylindrical, coarse, and black, yellow or yellowish brown skin, flattened nose, and languages almost devoid of inflections. It includes the Hyperboreans (Laplanders, Esquimaux, etc.), the Mongols (Kalmuks, Yakuts, Tartars or Turks, etc.), and the Sinaic branch (Chinese, Japanese, and Siamese).

The Brown race is distinguished by a deep brown skin, and seems to be the result of the mixture of the white and yellow, and black and yellow races. Its languages are a community of roots of words, but not of the words themselves. This race includes the Malay family (the original inhabitants of the peninsula of Malacca, of the islands of Polynesia, and of the East Indies, — Dyaks, Madurese, etc.), the Hindoo family (natives of Hindostan and the island of Ceylon), the Ethiopian family of Eastern Africa (Abyssinians and Fellans).

The Black race is recognized by its very dark skin, short, curly hair, which is elliptical in section, high, narrow skull, flattened nose, thick, protuberant lips on prominent jaws, and by the upper limbs being comparatively shorter than the lower limbs, hence less like the ape than in Europeans. The languages are peculiar in construction, the cases of nouns being generally determined by the prefix instead of by the ending, as in Latin. The various families of this race occupy the central and southern portions of Africa and Oceanica, and include native Australians.

The Red race consists of the descendants of the aborigines of the whole Western Continent, and is known by its location, retreating forehead, large back head, broad eye sockets, red complexion, and savage, vindictive spirit. It is undoubtedly descended from the yellow race, and has become modified in character by its isolation, surroundings, and the peculiarities of life and climate. Its language is formed by compounding root words, and not by prefixes and suffixes in the usual significations of those terms.

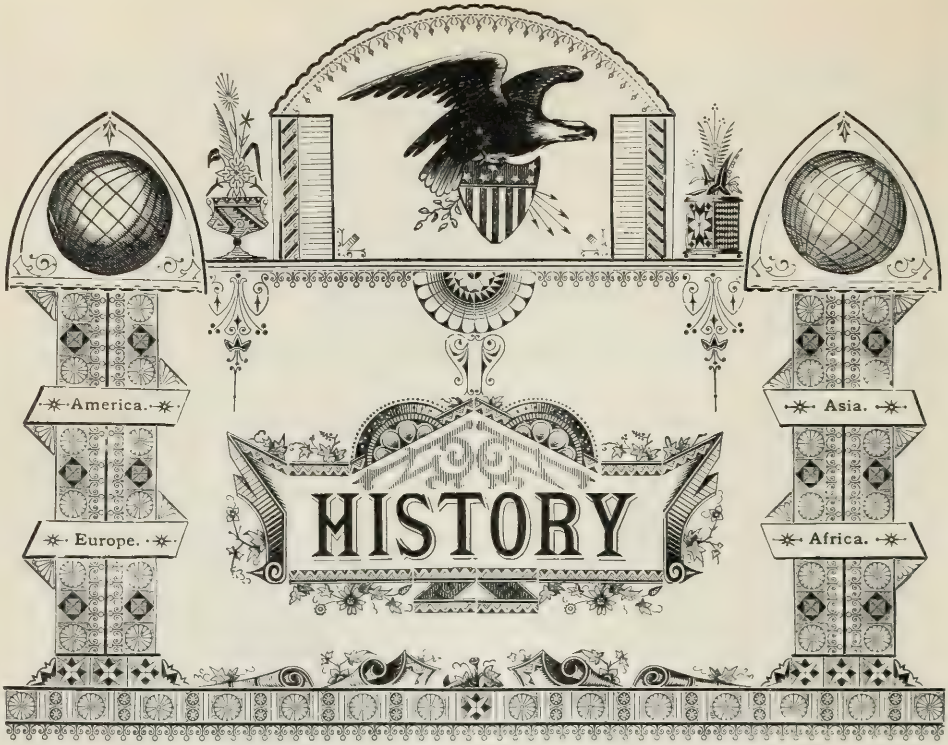
For engravings representative of the races, see page fronting table of contents of first volume.

CONDITION OF THE HUMAN RACE — CIVILIZING INFLUENCES. — About fourteen hundred millions of human beings are scattered over the face of the earth, of all nations and kindreds and tongues, and in all stages of civilization, from a high state of moral and intellectual culture to savages, but little above animals, that contend with them for the dominion of the deserts and forests through which they roam. Of these millions about four hundred and ninety-five belong to the White race, five hundred and sixty-three to the Yellow race, one hundred and eighty-three to the Brown race, one hundred and fifty-two to the Black race, and twelve to the Red race. Animals and vegetables, being the sources of man's sustenance, have had the chief influence on his destiny and location, and have induced him to settle in those parts of the world where he could procure them in greatest abundance. Wherever the chase or the unaided productions of the earth supply him with food, he is completely savage, and only a degree further advanced where he plants the palm and the banana; but where grain is the principal food, industry and intelligence are most perfectly developed, as in the temperate zone.

The influence of external circumstances on man is not greater than his influence on the material world; he cannot create power, it is true, but he dexterously avails himself of the powers of nature to subdue nature. Air, fire, water, steam, his own muscular strength, and that of animals rendered obedient to his will, are the instruments by which he has converted the desert into a garden, drained marshes, cut canals, made roads, turned the course of rivers, cleared away forests in one country and planted them in another. By these operations he has altered the climate, changed the course of local winds, increased or diminished the quantity of rain, and softened the rigor of the seasons.

The more man advances in civilization, the greater will be his collective influence, for knowledge is power; and at no time did the mental superiority of the cultivated races produce such changes as they do at present, because they have extended their influence to the uttermost parts of the earth by emigration and commerce. In civilized society, the number of people in the course of time exceeds the means of sustenance, which compels some to emigrate; some are induced by a spirit of enterprise to go to new countries; some for the love of gain, and others to escape from oppression. The discovery of the New World opened a wide field for emigration. Every country has its own peculiar productions, and by an unrestrained interchange of the gifts of Providence the condition of all is improved.

The history of former ages exhibits nothing to be compared with the mental activity of the present. The facility of communication is rapidly assimilating national character. Society in most of the large cities is formed on the same model; and as the study of foreign languages is now considered a part of polite education, one of the great barriers to the intercourse of nations will soon be removed.



HISTORY

HISTORY is a record or narrative of man's actions in the past. It treats of the rise and fall of nations; shows their connection and intercourse, with the resultant influence and effect; and describes the habits, manners, and customs of their people. A knowledge of history is most desirable, from the fact that we can glean from its pages the experience of those who have figured in all the different walks of life; their mistakes and blunders serving as beacons to deter us from pursuing a similar course, while their successes and deeds of glory in laudable enterprises stimulate us to emulate and rival them in, if possible, greater achievements. It shows us what the wisdom of past ages has done for civilization, and how the literature, science, and art of modern times have tended to the amelioration of mankind and the establishment of free governments.

As in a work of this kind it would be impossible to give in detail the events and circumstances which, in the great countries of ancient and modern times, go to make up their history, we purpose treating of them as concisely as is consistent with clearness.

The early history of all the nations of antiquity before the discovery of the art of writing is obscured by legend and mythology. The first application of writing, however, for the perpetuation of historical events, was by inscriptions on monuments, the examination of which has systematized our knowledge of the history of Oriental countries. Papyrus was utilized for writing purposes about three thousand years before Christ, and from this might be dated the beginning of historical literature.

History is divided into Ancient, Mediæval, and Modern. Writers disagree as to when ancient history ends and mediæval begins, some limiting the period of the former to the fall of the Roman Empire (A. D. 476), and some extending it to the establishment of the New Empire of the West, under Charlemagne, A. D. 800. The weight of authority, however, fixes it at A. D. 476, and defines it as including all history from the creation to that time. Mediæval history, or the history of the dark ages, ranges from the fifth to the close of the fifteenth century, when modern history begins.

Herodotus, who is generally called the *Father of History*, treats of the history of Oriental nations from the eighth to the fifth century before Christ, while for the period elapsing from the creation to the annals of Herodotus the Old Testament is the only work making any pretensions to a consecutive historical narrative.

ASIA.

ASIA is the most extensive, the most diversified, and, so far as the early history of mankind is concerned, the most interesting of the great divisions of the globe. It embraces the northeastern portion of that great mass of land which constitutes what is generally known as the Old World, and contains about seventeen million square miles, or one twelfth of the whole surface of the globe.

The principal countries of Asia are China, Japan, India, Asia Minor, Arabia, Afghanistan, Persia, Siberia, Burmah, Siam, Malaya, Anam, and Beloochistan.

The progressive races of Europe had their origin in Asia. Here, also, arose all the forms of religion which have so greatly influenced the history of mankind,—the Vedantic or Brahministic, the Buddhist, the Hebrew, and more especially Christianity and Mohammedanism.

We can see from our sketches of ancient history how the movements of the population of Central Asia have affected the surrounding regions, and how the condition of almost the whole continent, from the earliest ages to the present time, has been such as to invite foreign conquest and to lead to the supremacy of foreign races over all its portions.

As regards civilization, whatever may have been the condition of Syria, Persia, India, and other celebrated nations of antiquity, the greater portion of Asia is in a state of semibarbarism.

The European powers having possessions in Asia are,—

Russia, which occupies the whole of Siberia, partly as a mineral and trading region and partly as a penal settlement.

Britain, which has acquired the ascendancy, if not the actual possession of the most of Hindostan, Ceylon, Assam, various settlements on the Burmese and Malayan coasts, the valuable little island of Singapore in the Strait of Malacca, the island of Hong Kong at the mouth of the Canton River in China, and the rocky peninsula of Aden in Arabia.

France, which owns the small districts of Pondicherry, Vellenour, Chandernagore, Grojam, Caricall, Mahe, etc., on the coast of Hindostan.

Portugal, which still possesses the maritime districts of Damuan, Dia, Goa, and Margaon.

And Turkey, which is partly a European and partly an Asiatic country, and occupies, in Asia, all of Asia Minor and Mesopotamia to the Persian frontier; also the Arabian and Syrian deserts and thousands of islands in the Mediterranean Sea.

BABYLON AND ASSYRIA.

Nimrod, "the mighty hunter," and grandson of Ham, organized the different tribes inhabiting the plain at the head of the Persian Gulf, under a single government, and founded Babylon about 2300 B. C. It is generally supposed that Babylon and Assyria were distinct kingdoms till the conquest of the former by Ninus, whose capital was Nineveh, and its consequent annexation to the Assyrian Empire.

After making extensive conquests, Ninus married *Semiramis*, who is described as a woman of great beauty and possessed of extraordinary talents for government. On the death of her husband she assumed the sceptre, enlarged Babylon, extended her territories by the addition of a great part of Ethiopia, and was succeeded by her son, *Ninyas*.

Ninyas was in no respect like his heroic parents, but was wholly devoted to sensual pleasures. Of his successors for several centuries little or nothing is known, except that they ascended the throne, lived in indolence, and died in their palace at Nineveh.

Sardanapalus surpassed them all in effeminacy and voluptuousness. Arbaces, governor of Media, threw off his allegiance and defeated the Assyrians; and Sardanapalus, to escape falling into the hands of his conquerors, set fire to his palace and perished in the flames, 747 B. C. This ended the first Assyrian Empire, which had existed fifteen centuries.

It was then divided into three kingdoms,—Media, Assyria, and Babylon. Arbaces retained the supreme authority and fixed his residence at Ecbatana in Media. The government of Babylon was bestowed on Belesis or Nabonassar, and Phul or Pul received that of Assyria.

The Assyrian ruler gradually augmented his territory, and was succeeded by Tiglath-pileser. Shalmaneser, who succeeded him, took the city of Damascus and put an end to the kingdom of Israel. His successor, Sennacherib, led a large army against Jerusalem, which expedition proved unsuccessful, and on the return of Sennacherib to his capital he was assassinated, and was succeeded by his son, Esarhaddon, who seized Babylon and annexed it to the kingdom of Assyria. He also conquered Egypt and Judea.

Esarhaddon was succeeded by his son, Asshur-bani-pal, who was engaged in wars with the Medes and Scythians, from the exhaustive effects of which his country never recovered. His son and successor, Saracus, in a war with the Medes, was betrayed by Nabopolassar, one of his generals, who formed an alliance with the Median king, Cyaxares, and captured Nineveh. Saracus burned himself in his palace, and the conquerors divided Assyria between them, 625 B. C.

Nabopolassar left the crown of Babylon to his son, Nebuchadnezzar the Great, who pillaged and burnt the city of Jerusalem and put an end to the kingdom of Judah, 589 B. C. He also conquered Phœnicia and Egypt, made many internal improvements in his kingdom, and built the celebrated "Hanging Gardens of Babylon," one of the seven wonders of the world. Many particulars of the reign of this remarkable personage are recorded in the Book of Daniel.

Evil Merodach succeeded to the throne, and, after a reign of two years, was put to death by his own relatives, when Neriglissar, his brother-in-law, assumed the crown. He died, after a reign of three years, leaving his kingdom to his son, Laborosoarchod, who was deposed and put to death after the reign of a few months, and the crown devolved to Belshazzar. This prince saw, in the midst of a festival, a handwriting appear on the wall, which was explained by Daniel to signify his death and the ruin of his kingdom by the Medes and Persians. The same night the Persians, under Cyrus, diverted the waters of the Euphrates from their course, entered the city through the dried channel, and slew Belshazzar in his banquet-hall. Thus ended the Babylonian kingdom, and the site of its once magnificent capital is to-day marked only by shapeless mounds dotting a desolate plain.

PHŒNICIA.

Phœnicia was a very important country of the ancient world, and the Phœnicians are the most interesting of the peoples of early history. Their origin, like that of some other nations, is shrouded in the darkness of primitive history. They were supposed to have emigrated from Chaldæa, Southern Mesopotamia being their native seat. The importance and interest of this country do not arise from the extent of its territory, for Phœnicia proper was all comprised in a strip of land 180 miles long and 12 broad, extending from Mount Lebanon to the Mediterranean Sea, but from the fact that the Phœnicians held a high place in the history of early civilization.

Situated, as they were, at the junction of three continents, they carried on the trade of the world. As early as the ninth century before Christ they had founded the colony of Carthage on the northern coast of Africa, a colony which flourished for over seven hundred years, and coped, with varied success, with the mighty power of the commonwealth of Rome. They settled the islands of Cyprus, Sicily, and Sardinia; made their way beyond the Pillars of Hercules (now the Strait of Gibraltar), and founded the city now known as Cadiz, in Spain. Their merchants sailed over the Atlantic Ocean, sought the southern parts of the British Islands, and procured tin from the mines of Cornwall.

The Phœnicians also planted establishments on the Red Sea and Gulf of Persia, from which they carried on a considerable trade with Ceylon, India, and the coasts of Africa. From this we notice that they were navigators, merchants, and founders of colonies before the Greeks were known. They were also the first of the ancients who used an alphabet representing articulate sounds.

Phœnicia was composed of several independent states; in fact, each city was the seat of a separate state under its own king, and it was only in times of great danger that they united under the lead of the most powerful.

The chief cities of Phœnicia proper were Sidon and Tyre. Sidon was the most ancient and the most flourishing and progressive of all the Phœnician communities up to 1050 B. C., about which time the lead was taken by Tyre, whose ships sailed to Tarshish (Southern Spain) and sought the gold of Ophir, on the southeast coast of Arabia. Phœnicia was also enriched by exports, such as the embroidery and glass of Sidon, and the "Tyrian purple," a dye obtained from two shell-fish, and which placed a high value on all stuffs of the Tyrian looms. Being skilled in metallurgy, their gold and silver vessels, bronzes, and other works in metals were of high repute.

When Tyre became the leading city of Phœnicia, Hiram, its king, made a commercial alliance with David and Solomon of Israel, and furnished a large part of the materials for the Jewish Temple.

Phœnicia was successively subject to the Assyrians in the ninth century; to the Egyptians and Babylonians in the seventh; to the Persians, under Cambyses, in the sixth; to the Greeks, under Alexander, in the fourth; and to the Romans in the first century before Christ; and finally to the Mohammedans, who still retain it.

Phœnicia was at its highest period during the five hundred years intervening between the eleventh and sixth centuries before Christ. They were the only Asiatic people that became the medium of civilization, or that were among the earliest colonizers, carriers, and merchants.

PALESTINE.

Palestine is sometimes called Judea, the Holy Land, the Land of Israel, and Canaan.

From the accounts given in Scripture, and from the History of Josephus, we learn that the Jews were descended from Abraham, the tenth in descent from Noah in the line of Shem.

According to Josephus, Abraham left the land of Chaldæa at the command of God, and went into Canaan, where he and his posterity dwelt. He was the first to publish the doctrine that there was but one God, the creator of the universe.

After the death of Abraham's son, Isaac, his (Isaac's) younger son, Jacob, remained in Canaan with his twelve sons, one of whom, Joseph, as related in Scripture, was the cause of the removal of his father and brethren into Egypt.

Each of the twelve sons of Jacob became the progenitor of a family or tribe, and the twelve tribes continued to reside in Egypt, where they increased in numbers and wealth. The Israelites fled from Egypt to Canaan, under the guidance of Moses, 1490 B. C.

God delivered to Moses the tables of a moral law, embracing the Decalogue, and promulgated a set of regulations for the civil government of the nation.

Canaan being occupied by warlike tribes, the Israelites had to fight for its possession, which they obtained 1450 B. C.

The political government of the tribes was republican, with military leaders, called judges, who acted under the direction of the priesthood. The period of the judges lasted over three hundred years, and may be called the Heroic Age of the Jews.

The judges were succeeded by kings. Saul, the first monarch, was succeeded by David, who was a soldier and conqueror. He, in turn, was succeeded by his son Solomon, under whose reign the Jews first began to have commerce with other nations.

After the death of Solomon, Palestine was divided into two kingdoms, — the Kingdom of Israel, which was conquered by the Assyrians, 722 B. C., and the Kingdom of Judah, which was conquered by Nebuchadnezzar, 588 B. C., who also destroyed Jerusalem and carried great numbers of Jews into captivity at Babylon. Seventy years afterwards, when Cyrus, king of Persia, subverted Babylon, the captives were permitted to return.

About 450 B. C., Ezra, a Jewish priest, had the books of the Old Testament definitely arranged. Judea remained under Persian rule till the time of Alexander the Great, when it became part of his dominions. It afterwards fell under the rule of Egypt and Syria respectively. In the reign of Ptolemy II., the Hebrew Scriptures were translated into the Greek language, which translation is called the Septuagint.

Herod, governor of Galilee, obtained the crown of Judea by the assistance of the Romans. It was in the last year of his reign that our Saviour was born at Bethlehem, and the Christian era began. After Herod's son and successor, Archelaus, had been deposed, Judea was reduced to a Roman province, governed by Roman procurators, and it was during the administration of the first four of these procurators that our Saviour executed the great mission which he came on earth to accomplish.

During the administration of Pontius Pilate, the fifth Roman procurator of Judea, the crucifixion, resurrection, and ascension of our Saviour took place.

On account of the tyranny of these governors, a revolt broke out in Judea against the Romans, A. D. 69. It resulted in the capture and destruction of Jerusalem by Titus, A. D. 70, and terminated the political existence of the Jewish nation.

Since A. D. 1517, Palestine has formed part of the Turkish Empire.

MEDIA AND PERSIA.

The early history of the Medes is referred to in our chapter on Babylon and Assyria. They captured and destroyed Nineveh in the seventh century, and Persia was tributary to them till the accession of Cyrus the Great, who succeeded his father, Cambyses, on the throne of Persia. Cyrus conquered Media and established the Medo-Persian, the second great empire of Western Asia. Lydia, the Greek cities of Asia Minor, and Babylon were in a short time added to his dominions, and, before the end of his reign, the Persian monarchy included all the countries from the river Indus to the Euxine and Caspian Seas.

Cyrus was a moderate and magnanimous monarch, and on his death, 529 B. C., the sceptre passed into the hands of his son Cambyses, who was a perfect tyrant. He invaded Ethiopia and lost a large army on the burning sands of the desert. On his return he committed suicide, and was succeeded by the Magian Gomates, who personated Smerdis, the son of Cyrus.

The usurper began his reign with such acts as were most likely to win the esteem of the people, but his efforts to supplant the religion of Zoroaster caused the people to rebel against him; and Darius I., the heir presumptive to the crown, became monarch, 521 B. C. He divided the empire into twenty satrapies or governments, reduced his rebellious provinces to submission, and made Thrace and Macedonia tributary to Persia. Darius attempted to subjugate Greece, but sustained a crushing defeat at Marathon. He died 486 B. C., and was succeeded by his son Xerxes, called in Scripture, Ahasuerus.

Xerxes put an end to the revolt of the Egyptians, and established his brother as viceroy of the province. He invaded Greece with a vast army (amounting, according to Herodotus, to over two million men). The expedition proved unsuccessful, his fleet being completely destroyed, and he who crossed the Hellespont with so much ostentation was compelled to recross it in a fishing-boat. He was assassinated by Artabanus, the captain of his guard, 465 B. C.

Artaxerxes Longimanus (the long-handed) succeeded to the throne, and reigned upward of forty years, during which the independence of the Asiatic Greeks was recognized, and all the Greek cities in Asia Minor, south of the Hellespont, were ceded to the Athenian Confederacy.

Xerxes II., son of Artaxerxes, had worn the crown only forty-five days when he was assassinated by his illegitimate brother Sogdianus, though the fratracide was scarcely seated on the throne when his brother Darius II., or Ochus, killed him, and assumed the government.

The most prominent events in the reign of this monarch were the re-establishment of Egyptian independence, and the renewal of Persian authority over the Greeks of Asia Minor. After a reign of nineteen years, the crown devolved to Artaxerxes (Mnemon), against whom his brother Cyrus rebelled, assisted by the Greeks; but the rebel was slain, and Xenophon, a Greek general, conducted the famous Retreat of the Ten Thousand.

Artaxerxes was succeeded by his son Ochus, who assumed the name of Artaxerxes III., and whose reign was marked by the most barbarous cruelties. He was poisoned by an Egyptian eunuch named Bargoas, to whom the administration of affairs had been intrusted.

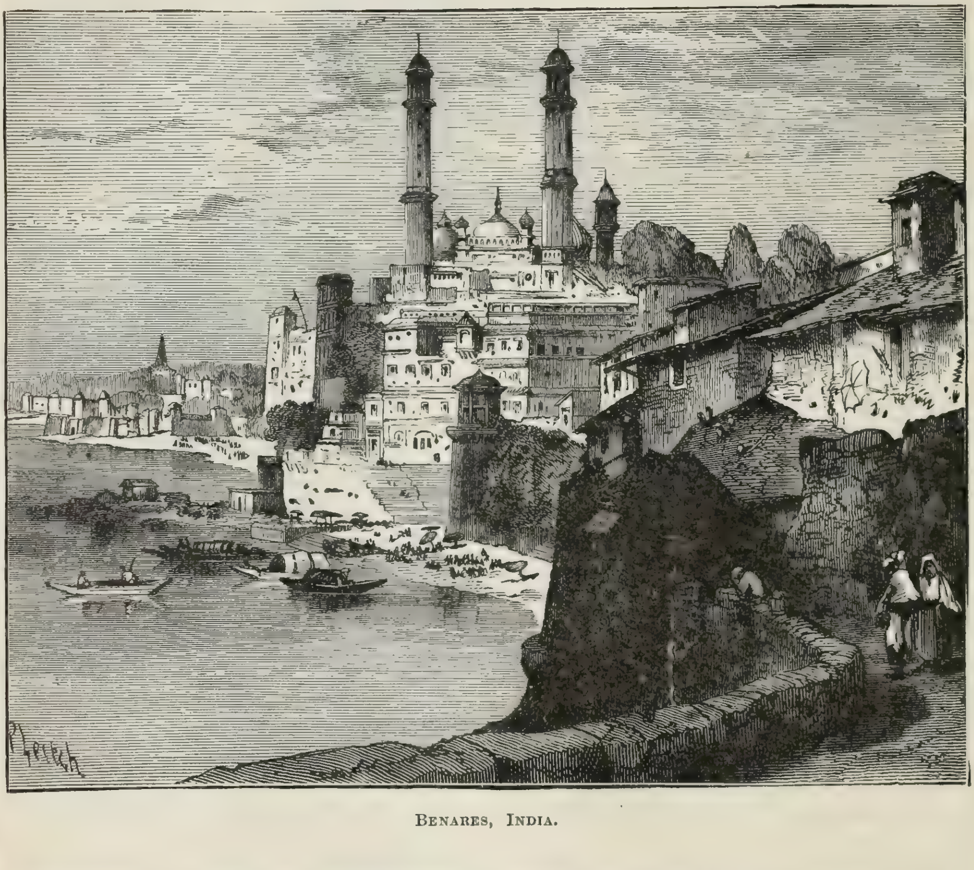
Arses succeeded to the throne, but he soon shared the fate of his predecessor, and Bargoas bestowed the crown on Darius Codomannus (Darius III.), who was at that time governor of Armenia. During his reign, Alexander, king of Macedon, crossed the Hellespont with a formidable army, to avenge the injuries which Greece had received from the Persians, and by successive victories he became (after the battle of Arbela) master of the Persian dominions.

Darius fell the victim of a treacherous conspiracy, and the Persian Empire terminated 330 B. C., after an existence of over two centuries.

INDIA.

The Aryan stock, from whom are descended the white or enlightened races of to-day, is supposed to have originally resided in Asia. The exact locality is assigned by scholars to the northeast of Persia, in the region of the Oxus and Jaxartes Rivers, and the earliest information we can obtain of the Aryans refers to about 3000 B. C.

India at the time was probably occupied by native dark tribes, which the Aryans who migrated to India subdued. The Aryans were progressive and practical, and advanced considerably in philosophy and literature. Some of the Aryans emigrated through Asia and into Europe. The Indian branch of the family lost some of its purity, and eventually almost lost its identity by intermixing with neighboring tribes, and the progress of the Hindoos apparently came to a stand-still, so that they have had very little influence on the current of the world's history. Their kinsmen, the Persians, not having intermixed, developed more of the characteristics that marked the European part of the Aryan stock.



Benares, India.

India first came into notice upon its invasion by Alexander the Great, 326 B. C., in his expedition with the intent to conquer the world. The historians who were with this expedition brought back with them a description of the manners and customs of the people which is applicable in many respects to the inhabitants at the present day.

In the time of Alexander, society was firmly fixed in castes. There were four divisions: I. The Brahmins, who attended only to religion and philosophy; II. The Kshatriyas, who controlled the wars and the government; III. Vaisyas, who were merchants and farmers; and IV., the Sudras, or artisans and laborers. Even lower than the latter were the Pariahs, or outcasts, who were called upon to perform the meanest of all work. Each had to follow the vocation of his caste, and intermarriages were rigidly prohibited.

The ancient Hindoo language was the Sanscrit; at present it is only spoken and understood by the Brahmins and those of the population who have studied it. It bears a marked similarity to the Greek, Latin, German, Celtic, and Slavonic languages, and though not now regarded as the parent of these dialects, it is looked upon as the nearest approach to the original speech of the undivided Aryans.

Much of the ancient literature of Hindostan is preserved to the present day. The Vedas, which form part of the sacred books of the religion of the Brahmins, are thought to be as old as 2000 B. C. They set forth the doctrine that there is one "unknown, true Being" who is invisible, and who manifests himself in three forms: as Brahma the Creator, Vishnu the preserver, and Siva the destroyer.

The principal point in their theology is the doctrine of the soul's transmigration; that is, the transition of the human soul after death to another body or substance, its final aim being to reunite itself with the Divine Spirit of the universe. The Hindoo regards his existence in this sphere as a burden to be lightened by self-denial, sacrifices, etc., neglecting which, his soul, after death, will be joined to the body of an inferior animal, and will have to commence its wanderings anew.

There are many fine pagodas, temples, etc., dedicated to their gods, some of the temples being cut out of solid rock.

In the sixth century B. C., an Indian prince named Gautama formed a sect called Buddhists, who are the opponents of the old Brahmins, and may be regarded as reformers, whose tenets spread rapidly, and constitute at the present day a religion embraced by one third of the race.

In 1613 the English first obtained foothold in India. Since then they have gradually gained possession of the whole country. In 1857 a rebellion broke out, during which the English garrisons and European residents were massacred in cold blood, and these atrocities were rivalled by the English who indiscriminately slaughtered the rebels, many of the Sepoys being shot from the mouths of the cannons. The rebellion was suppressed in 1859, and in 1876 Queen Victoria was proclaimed Empress of India.

ARABIA AND THE SARACEN EMPIRE.

Arabia comprises all that southwestern peninsula of Asia inclosed by the Persian Gulf, the Indian Ocean, and the Red Sea.

Ancient geographers describe it as having three physical divisions. The northwestern was called *Arabia Petræa*, on account of its stony character; the central, *Arabia Deserta*, because of its sterility; and the southern and southwestern, *Arabia Felix*, on account of its remarkable fertility, Thence came to Egypt and Europe all kinds of spices, incense, and myrrh. There, by general repute, could be found in boundless quantity gold and silver and precious stones. This division, under the name of *Yemen*, was controlled by the HIMYAR dynasty from the earliest time of which history and tradition give us any glimpse; and its people are believed to be descendants of SHEM, one of the sons of Noah.

The descendants of KAHLAN, a brother of Himyar, had a wandering tendency, and by gradual progress from oasis to oasis of the desert, came to the eastern coast of the peninsula, and continued northward along the shores of the Persian Gulf and the left bank of the Euphrates River to a fertile country next the Persian boundaries, where they founded the kingdom of *Hira*. A portion of these wanderers went westward into Syria, and founded the kingdom of *Ghassan*. These kingdoms, Himyar, Hira, and Ghassan, were the only approach to general rule in the history of the Arabs till the time of MAHOMET; and even in these cases the central government had but slight influence over the innumerable independent sheiks, or heads of families.

The patriarchal form of government has been the universal one, and never varied in the least through all Central Arabia and Arabia Petræa or Hejaz, whose inhabitants are an amalgamation of the tribes above mentioned with the descendants of ABRAHAM through his son ISHMAEL. They founded *Mecca* and *Medina* in Hejaz at so early a date that we only know they were in existence before authentic history began; and that according to Arabic tradition they were founded by Abraham, in connection with his son Ishmael.

From time immemorial *Mecca* has contained the *Kaaba* or *Sacred Temple*, with its black stone, the shrine to which all Arabia makes yearly pilgrimage.

The peculiar position and physical character of Arabia have kept it from foreign conquest, and made the institutions of its people permanent. Each one of its numerous independent families or tribes is governed by the same code of laws, morals, and honor; but the principle of cohesion, necessary to make a central power, has always been wanting.

At the birth of Mahomet, in A. D. 570, it had yet to be determined whether any force could bring these tribes to act with one accord and purpose; but we shall see that, under the influence of religious sentiment and enthusiasm, even they could be united. Ferocity and generosity are the commanding traits of Arab character; the former blazes in war, and the latter glows in peace. Both became strongly manifest in the first years of Mahomet's teachings.

Mahomet's family was distinguished, belonging to the *Hussein* branch of the tribe of *Koreish*, to which were attached the guardianship of the *Kaaba* and the chief magistracy of Mecca. His father and grandfather were high dignitaries, his mother was a Jewess. These facts undoubtedly contributed to his final success.

Mahomet attracted no special notice, and was known only as a successful merchant until he was about forty years of age; but he had given much of this earlier period of his life to deep meditation, and had in mind laid the foundations of a religion which should unite all Arabia in national feeling, and entirely supersede that superstition and idolatry which were almost a part of the Arab nature.

This species of idolatrous worship at Mecca was, however, founded upon patriarchal traditions believed to be common to Christianity and Judaism, and this fact was the pivot upon which Mahomet rested his spiritual lever. Having the superior intelligence of a great mind, united with a thorough knowledge of Arab character, he skilfully employed designs of expediency in removing prejudice, and appealed to the worst side of human nature in the Arab's love of war and plunder. It is only just to Mahomet to say that he only took this course when it became apparent that in no other way could his designs for the benefit of his people be rendered effectual.

He began by the announcement, at an assembly of his kinsmen and friends, that he had been directly inspired by the Ruler of the universe, the only true God, to reform the religion of the Arabian people. He was denounced as an impostor by the people of Mecca, and soon forced to flee for his life to the city of Medina. His doctrines, as written from time to time, received the name of the *Koran*, or Reading; because he read them to assemblies of the people. The religion inculcated was called *Islam*, or "Salvation."

From the time of his flight, or *Hegira*, on July 15, 622, he began to teach that the true religion must be forced upon all nations by "the sword, the key of heaven and hell."

Henceforth he carried all before him, though not without severe contests, and in ten years every Arab was a *Moslem;* at least, in form if not in belief.

When we consider the character and traditions of the people with whom he had to deal, the result must be considered one of the most wonderful events of history.

At his death, which occurred at Medina, June 7, 632, he was succeeded by his father-in-law, ABU-BEKER, who was both the spiritual and temporal ruler. He was called *Caliph*, or Successor, and that title has been applied to all who have succeeded him.

Mahomet's method of proselyting was continued with wonderful success for centuries. All the conquered were forced to choose one of three things: the *Koran*, *tribute*, or *death*. So rapidly did the Saracen Empire increase in power under this system, that in 668 it possessed all *Asia Minor*, and had begun the siege of *Constantinople*. This was its limit in this direction; it was never able to break this formidable barrier. Peace, however, was not a part of the Saracen religion, and soon the Mahometan hosts were fighting their way along the northern coast of Africa, and *Cyrêne*, *Tripoli*, and *Carthage* were, in turn, subdued.

In 710 *Spain* was invaded, soon overpowered, and remained a part of the Saracen Empire for seven hundred years. A dispute as to the right of succession to the Caliphate arising in 755, the Spanish portion of the empire was given to one Caliph, while the remainder was ruled by a Caliph at *Bagdad*.

The most distinguished of the Caliphs was HAROUN-AL-RASCHID, in the eighth century, a contemporary of Charlemagne, and as powerful as Charlemagne himself. The Eastern Empire was destroyed by the Turks in 1278; but the Western Empire in Spain continued till the close of the fifteenth century.

During the continuance of the Saracen Empire, it did more for the advancement of learning, more for the fostering of science and art, more for the increase of commerce, the development of industries, and the general enlightenment of the world, than did all other nations combined; and though, politically, Arabia has returned to nearly its original significance, yet the religion of its prophet has continued to be propagated, until to-day there are in existence, probably, half as many Mahometans as of all sects of Christians combined.

CHINA.

The early history of China, like that of every ancient people, is more or less clouded by fable. It was an ancient belief of Chinese writers that a period of 2,267,000 years elapsed between the time man was produced and given possession of the soil of China and the time of Confucius. As a consequence, the early historians invented long lines of dynastic rulers to fill up the gap between the creation and the period with which the book of historical documents by Confucius commences. The first glimmer we have, however, even of obscure history, commences with the reign of Yew-chaou She, who was chosen to direct the counsels of the people and lead their armies. His fourth successor, Chin-nung, is said to have invented the plough, and from that moment the civilization of China proceeded by rapid and progressive steps. To Se-ling-she, the wife of the next sovereign, is ascribed the honor of having first observed the silk produced by the worms, of having unravelled their cocoons, and of having worked the fine filaments into a web of cloth.

The compilations of Confucius (born 551 B. C.) commence with the reign of Yaou, 2356 B. C. The next occupant of the throne was Shun, who in turn was succeeded by the "great" Yu, who drained off the waters of the flood which had visited the north of China, in consequence, probably, of one of the numerous changes in the course of the Yellow River. His successors were faithless and dissolute rulers, and a revolution established a new line of monarchs under the name of the Shang dynasty, 1766 B. C.

The monarchs of this line gradually lost their hold on the affections of the people, and were finally supplanted by the Chow dynasty. Internal wars and the attacks of the Tartars made the country fall an easy prey to the powerful neighboring state of Thsin, whose king fixed his capital at Chang-gau, in China. His grandson, Che Hwang-te, who ascended the throne 246 B. C., was one of the greatest rulers China ever had. He constructed roads through the empire, formed canals, and erected numerous and handsome public buildings. The Tartars, who for years kept the Chinese in a state of disquiet, were completely routed by him, and he built the gigantic Chinese Wall, which stretches across the whole northern limit of the huge empire, the object of which was to prevent incursions from the neighboring states.

Within a few years after the death of this monarch a new line of rulers was established, styled the Han dynasty, which continued for two centuries, and which was followed by the Eastern Han dynasty. It was during the rule of the latter that Buddhism was introduced from India into China, A. D. 65.

The empire was divided and governed by three monarchs, A. D. 220, which was called the period of the "Three Kingdoms." It was again united by Zang Keen (590), who exercised undivided authority.

The next two centuries were marked by feeble governments, oppressions, and rebellions. The middle of the ninth century, or during the rule of the Tang dynasty, is regarded as the golden age of Chinese literature.

Chinese Temple.

About the beginning of the twelfth century the Mongols began to acquire power in Eastern Asia. They invaded China, and under their celebrated leader, Jenghiz Khan, conquered a great part of the country. The contest was kept up for a number of years, till in 1232 Kublai-Khan, the Mongol ruler, conquered the entire Chinese Empire. During the reign of his successors insurrections frequently occurred, and in 1368 Choo Yuen-Chang, the son of a Chinese laborer, was declared emperor. He founded the Ming ("Bright") dynasty, and cultivated friendly relations with the rulers of the neighboring states. Twelve emperors of the Ming dynasty reigned in comparative peace, till in 1618, during the reign of Wan-leih, the Manchoo Tartars established themselves in the empire, A. D. 1644.

This dynasty and their partisans conformed to the laws, customs, and usages of the Chinese, with one exception. The people were ordered to change their national costume and to assume the dress of the Tartars. This occasioned resistance on the part of the Chinese, but their leaders, not being united, were easily subdued.

In the latter part of the eighteenth century Keen-lung aided the Thibetans to repulse an invasion from Nepaul, and finally got control of Thibet, leaving to the Grand Lama only spiritual authority. He reigned for sixty years, and his dominions extended to the plain watered by the Oxus and Jaxartes. His son and successor, Kea-king, reigned for twenty-five years, and left a disturbed country and a disaffected people as a legacy to his successor, Taou-kwang.

In 1840 a war broke out with England on account of the English importing and introducing opium among the natives. The Chinese were beaten, and ceded Hong-Kong to the victors, besides paying them an indemnity of $6,000,000. A second treaty was concluded by the British in 1842, whereby the ports of Amoy, Fuh-chow-Foo, Ningpo, and Shanghai were declared open to foreign trade.

In 1850 a rebellion broke out in the southern portion of the empire, the leader proclaiming himself as sent by heaven to drive out the Tartars. He established himself as emperor in 1852, taking the title of Teen Wang, or Heavenly King, and made Nanking his capital.

The obstacles to commerce with foreigners led to a war with England and France in 1857. The French and English troops occupied Canton for four years, and the management of the customs at Shanghai and other ports open to foreign commerce was placed in the hands of foreign commissioners. When peace was concluded, the Chinese paid a war indemnity of 8,000,000 taels and permitted foreign ambassadors to reside at Pekin.

The war begun by Teen Wang in 1850 continued till 1864, when the heretofore victorious rebel was deposed and the old imperial authority restored.

A Chinese embassy visited the European powers and the United States in 1867, at the head of which was Anson Burlingame, formerly United States minister to China. He succeeded in effecting a treaty which established cordial commercial relations between this country and China.

Kwang-lin, the present sovereign, succeeded to the throne in 1875, and the first railway was built in China the following year. In 1882 the Congress of the United States enacted a law prohibiting the immigration of Chinese for ten years.

The area of China Proper, which is about half that of the whole empire, is 1,348,870 square miles; and the population is estimated at something less than 350,000,000, nearly one fourth the population of the whole world; the middle kingdom being more thickly settled than any other country in the world.

JAPAN.

The early history of Japan is recorded only in mythological legends. The native annals assert that the country was first governed by heavenly deities, who were followed by earthly deities, who in turn were succeeded by mortal sovereigns, of whom the present mikado or emperor is the one hundred and twenty-second. The earliest historical date accepted by the Japanese themselves corresponds to 660 B. C., when the first emperor, Jimmu, succeeded to the throne. The long line of sovereigns since that time comprises one hundred and eleven emperors and eleven empresses.

The present Japanese race is supposed by some writers to be of Chinese origin, but the majority of ethnologists set them down as an amalgamation of several different races, coming mainly from New Guinea and Corea.

In the Middle Ages the Chinese military system was adopted, which gave rise to the expression "military class," and which completely severed the agricultural class and the soldiery. As the military domination increased, the power of the mikado or monarch decreased, — a fact which gave rise to factions and resulted in many civil wars.

In A. D. 1281 the Chinese invaded Japan and suffered such a crushing defeat that no further attempt to conquer the country has since been made by the Mongols.

The sixteenth century saw the first persecutions directed against the native Christians. The religion had been introduced by the Portuguese in 1549, when St. Francis Xavier first came to Japan. Christianity was finally proscribed in 1614, and a decree of expulsion was directed against the Jesuit missionaries then in Japan, and persecution raged till 1637, when the Christians were all massacred. The inhabitants of Japan were forbidden to leave its shores without express permission, and the country was kept in seclusion from the rest of the world. Since 1858, however, treaties have been made with foreign powers, which introduced the foreign element into Japanese political affairs.

A great revolution occurred in 1868, which overturned the military system and restored the full power of the mikado. The court which had hitherto sat at Kioto removed, in 1869, to Yedo, the official name of which was changed to Tokio, the eastern capital.

Since this revolution Japan has become tolerably well known to Europeans. The government is in treaty with no less than eighteen nations. Christian missions have been established and schools opened throughout the country. An industrial exhibition was opened at Kioto, and an embassy arrived in Washington, in 1872.

The area of the long chain of islands which constitute the empire of Japan is stated to be 148,742 square miles. The whole empire is called by the natives Nippon or Nihon, which means "sun's origin"; that is, the land over which the sun first rises, and thus denotes the position the empire occupies in the extreme east.

Yokohama, about eighteen miles to the south of the capital, enjoys the greater proportion of the whole foreign trade of Japan. The chief exports are tea and silk; the former goes principally to the United States and to England, and the latter to the French markets.

The country has a population, according to the census of 1880, of 34,338,404.

SIAM is a country occupying the greater portion of the Indo-Chinese peninsula; has an area of 250,000 square miles, a population of 11,800,000, and is ruled by an absolute monarch, known by the title of "Sacred Lord," or "Lord of the White Elephant."

There is a deputy or vice-king, who has limited powers, and cannot, under any circumstances, become "Sacred Lord," yet is treated with the greatest respect. His office is not understood outside of the kingdom.

Siam is the equal of any Asiatic country in natural advantages, and, considering its extent, is not inferior in productions and commerce. The people are Mongolians, resemble the Chinese in many of their customs, and are Buddhists in religion.

AFGHANISTAN consists of a plateau 200,000 square miles in extent, averaging 4,000 feet in elevation above sea-level. It is situated north of Beloochistan, between Persia and India; has a surface the most diversified, and a soil and climate the most varied, of any country of equal extent on the globe, and yields from its soil every known product.

Its inhabitants number about 4,200,000, two thirds of whom are Afghans and Parthans, who profess the Mohammedan religion. They are independent, warlike, and generous, but inveterate robbers.

The government is monarchical in form. Shere Ali Khan is the present Ameer, but his policy, since 1879, has been dictated by England.

BELOOCHISTAN, situated between Persia and India, extends north from the Arabian Sea to Afghanistan, has an area of about 106,000 square miles, and a wandering population, similar to the Bedouins, of about 500,000, who are nominally ruled by a khan, but are practically in a state of anarchy, possessing nothing in substance or territory to invite the encroachments of neighbors or Englishmen.

BURMAH is, as now bounded, north of Siam and included between British India and China, and has an area of 200,000 square miles. The government is a monarchy, and the king has the title of "Lord of the Golden Palace."

The people are Buddhists, fully equal to the people of India in all respects; generally possess the rudiments of education, and are skilful in many of the arts. Their chief article of food is rice.

The Burmese language is very different from other Asiatic nations, being a dialect of the Sanscrit, with all the words monosyllables.

ANAM, or COCHIN CHINA, occupies 80,000 square miles of the eastern part of the Indo-Chinese peninsula. The people resemble the Chinese very closely; are Buddhists, liberal, skilful in many arts, and possess the rudiments of education. The government is a monarchy.

AFRICA

THIS continent, which was called Libya by the Greeks, and Africa by the Romans is the third of the great divisions of the globe in point of size, but by far the least important as regards the civilization and progress of the human race. It is of an irregular triangular form, and is attached to Asia by the Isthmus of Suez, the cutting of the canal through which has practically made it an island.

Its extent has never been accurately determined, but may be taken at 9,858,000 square miles, exclusive of the islands.

The parts of Africa hitherto known with any degree of accuracy were portions of Morocco and Algeria, certain parts on the seaboard of Senegambia, Upper and Lower Guinea, Cape Colony, Abyssinia, the Valley of the Nile, and certain tracks across the Sahara or Great Desert. Exploration is actively carried on by a number of adventurous travellers, who are almost daily adding to our knowledge, and enabling the map of Africa to be gradually filled in. The discoveries and explorations of Livingstone, Sir Samuel Baker, and Stanley have altered considerably the preconceived notion as to the interior of South Africa. They found there, instead of sterile wastes, well-watered, fertile, and populous countries, which are inhabited by tribes of negroes in a state of barbarity.

The foreign powers having possessions in Africa are,—

Britain, which occupies Cape Colony, which was taken from the Dutch in 1806; the Mauritius, with the minor island groups of Almirante and Seychelles, taken from the French in 1810; the Islands of St. Helena and Ascension, and the settlements of Sierra Leone and Cape Coast.

France, which owns the Isle of Bourbon, Madagascar, the settlement of Senegambia, and since 1830 the somewhat expensive, but now prosperous, colony of Algeria, and has lately conquered Tunis, which is, however, still nominally subject to the Bey, Sidi Ali.

Portugal, which occupies some settlements on the Mozambique coast, the coast of South Guinea, the Cape Verde Islands, Madeira, and the Azores.

Spain, to which belongs the Canaries, and the forts or districts of Ceuta and Melilah, near the Straits of Gibraltar.

Turkey, which holds a nominal supervision over Tripoli and Egypt.

The Republic of Liberia, a settlement of the American Colonization Society, was founded in 1822 for the purpose of removing free people of color from the United States. The enterprise has not succeeded very well, and its condition at present is not prosperous.

The Transvaal Republic in Southeastern Africa was founded by the Dutch boers, who emigrated from Cape Colony.

The most important country in Africa is Egypt, which possesses a high historical interest.

The countries of large extent not otherwise mentioned, and concerning which little is known, are Soudan and the Albert and Victoria-Nyanza region, lately visited by Stanley, who has since been outmanœuvred by a French gentleman in endeavoring to establish the shortest route for commercial intercourse with the principal interior tribes.

The population of the continent is vaguely estimated at 100,000,000.

EGYPT.

Of the early history of Egypt but little is known. On the building of its most ancient cities and the construction of its magnificent monuments history throws little light. It has been called the cradle of the sciences, as it was the principal source from which the Greeks derived their earliest information in scientific studies.

The rulers, previous to 2700 B. C., were supposed to be divinities. From this date, when Menes, the first king of Egypt known in history, reigned, till the incorporation of the country into the Persian Empire, Herodotus assigns Egypt three hundred and thirty kings (called in Scripture Pharaohs), who were divided into twenty-six dynasties.

Menes founded the cities of Thinis, or This, and Memphis. The former was supposed to form a part of the famous Abydos, or sacred city.

There is nothing in the history of the sovereigns who succeeded Menes worthy of particular notice till the fourth dynasty, or the age of the pyramid builders. The royal tombs of this period tell us of the magnificence of the kings; and the sepulchres, of the wealth of the subjects. The Great Pyramid near Gizeh, the most stupendous work of the age, was built by Shufu, or Cheops, the king of the fourth dynasty, of whom most is known. To Ptah-hotep, of the fifth dynasty, is assigned an ancient moral treatise, which is the best fruit of Egyptian thought that time has spared. The last king of this dynasty constructed the great truncated pyramid now called Mastabat Faraoon, or Pharaoh's Seat.

A great chasm in Egyptian history begins in the latter part of the sixth dynasty, there being no monuments to guide us till the time of Dynasty II.

During the period of the twelfth line of Pharaohs, Amenemhat III. constructed the vast artificial reservoir, Lake Moeris, which received the waters of the Nile by a canal, and after the inundation spread them over the country.

The Hyksos, or shepherd kings, a rude and barbarous race, invaded and conquered the greater part of Egypt during the thirteenth dynasty. They ruled the country for five hundred and eleven years, and were driven out by Misphragemethosis, a Theban ruler; after which Thebes became the Egyptian capital.

The greatest figure in the long line of Pharaohs was Rameses II., called by the Greeks Sesostris the Great. The greater part of his reign was given to the construction of those vast buildings which are found throughout Egypt and Nubia, and which give him the first place among the architect Pharaohs. He subdued nearly the whole of Western Asia, with some of the adjacent countries of Europe, and many of his monuments, to this day, stand sculptured with representations of his principal achievements.

Among the Egyptian rulers of this period was Osirtesen I., supposed by many writers to have been the Pharaoh that received Joseph, and Amenoph III., who erected the famous vocal Memnon, which still remains.

The exodus of the Israelites occurred in the reign of Menephtha, and the most approved chronology fixes the date about 1480 B. C.

The Assyrians, under Sennacherib, invaded Egypt, but his army perished miraculously in a single night, and Sennacherib fled to Nineveh. His son, Esarhaddon, however, renewed the invasion, subjugated the country, and made it an Assyrian province, 672 B. C. Psammetichus, of the twenty-sixth dynasty, after nearly a century of foreign rule, threw off the Assyrian yoke and restored Egyptian independence.

In 525 B. C., Cambyses of Persia invaded and conquered Egypt, and the country remained a province of the Persian Empire for nearly a century, when a successful revolt again established Egyptian rule, which continued till the complete subjugation of the country by Artaxerxes III. (Ochus), 340 B. C.

Thus fell the monarchy of the Pharaohs, after an unexampled duration of 3,000 years. More than 2,000 years have passed since, and though Egypt has from time to time been independent, not one native prince has sat on the throne of the Pharaohs. "There shall be no more a prince of the land of Egypt" (Ezek. xxx. 13) was prophesied as the final state of the land.

Alexander the Great easily wrested Egypt from the Persians. He founded the city of Alexandria, for a long time one of the greatest commercial cities in the world. On the division of Alexander's empire after his death, Egypt was assigned to Ptolemy Sotor, one of his generals, who also became master of Phœnicia and Judea. He founded the famous Alexandrine Library and Museum and built the Pharos, or white marble lighthouse, one of the seven wonders of the world. He was succeeded by his son, Ptolemy Philadelphus, who was a munificent patron of the arts and sciences, and who also drew into his kingdom the greater part of the maritime commerce of the East.

Ptolemy III., surnamed Euergetes, or the Benefactor, succeeded his father. He crossed the Euphrates and conquered the country as far as Babylon. His intercourse with the Romans was conducted with a friendly spirit, though he is said to have viewed their ambition with suspicion. He was the last of the great Macedonian kings of Egypt, and under him the country reached the summit of its later power and prosperity.

Under the first three Ptolemies, Egypt was the resort of the scholars of the world. Euclid, the geometrician; Hipparchus and Ptolemy, the astronomers; Eratosthenes and Strabo, the geographers; and Aristophanes, the rhetorician, all lived under their judicious administrations. And even the early Christian Church drew, at a later period, from the "Divine school at Alexandria," the eminent Fathers Origen and Athanasius.

The ten succeeding Ptolemies were, in the main, weak-minded and injudicious rulers, and as little of historical importance occurred under their administrations we shall merely enumerate their succession.

Ptolemy IV., surnamed Philopater (lover of his father), died a victim to his own excesses, 205 B. C. Ptolemy V., surnamed Epiphanes, after a reign marked by cruelty and incompetency, was poisoned 180 B. C. Ptolemy VI., who was engaged in a civil war with his brother Physcon, died by a fall from his horse, 146 B. C. Ptolemy VII. reigned but a few days, having been murdered by his uncle, Physcon, who succeeded him as Ptolemy VIII. His reign was odious and tyrannical. He was succeeded by his son, Ptolemy IX., surnamed Lathyrus, who, for a number of years, reigned jointly with his mother, Cleopatra.

He was for a time banished to Cyprus, during which Alexander I., of Syria, proclaimed himself king as Ptolemy X. Lathyrus was soon after restored, and was succeeded by Ptolemy XI., after whose death, Ptolemy XII., called Auletes, or the "flute-player," secured the throne. This monarch, at his death, ordered that his daughter, Cleopatra, and his son, Ptolemy, should reign jointly, and be married when Ptolemy was of full age. These instructions were indorsed by the Romans; but Cleopatra, ambitious to rule alone, went to war with her husband, and, with the assistance of Julius Cæsar, she was made sole queen of Egypt.

On the death of Cæsar, she favored Brutus and Cassius in their war against the Triumvirate, and her subsequent interview with Mark Antony, in Cilicia, was productive of the most fatal consequences to that famous warrior; he accompanied her to Egypt, passed his time in voluptuousness, and finally involved himself in a war which terminated in his complete ruin, and the elevation of Octavius, afterwards Augustus Cæsar, to universal dominion. Antony committed suicide, and expired in the arms of Cleopatra, who, failing to captivate Octavius by her wiles, to avoid his triumph procured her death by the venomous bite of an asp. This event, which happened 30 B. C., terminated the rule of the Ptolemies, after they had reigned in Egypt two hundred and ninety-three years from the death of Alexandria the Great. Egypt was reduced to a Roman province, and was governed by a prefect sent thither from Rome.

The period of Roman dominion, which continued for over three centuries, was marked by numerous rebellions, the rapid spread of Christianity, and a steady decrease in the population.

Zenobia, widow of Odentatus, Prince of Palmyra, who claimed to be descended from the Macedonian kings, conquered Egypt A. D. 270, and was acknowledged as its queen. She was defeated, however, soon afterwards, and her territory again added to the Roman dominions.

Christianity spread rapidly in the country, and, in the reign of Constantine the Great, was made the religion of the empire. Several contests occurred in the succeeding centuries between the Christians and Pagans, in which much blood was shed and valuable property destroyed. The Christians triumphed, and, in the reign of Justinian, an orthodox archbishop or patriarch of Alexandria was made Prefect of Egypt.

The country was conquered by the Persians, A. D. 616, and held by them for ten years, when it was retaken by the Romans. During the Persian occupation the Coptic Church was firmly established, and continued to receive the support of the people. The divisions and hatred existing at this period among the different Christian sects made the conquest of the country by the Mohammedans comparatively easy. Alexandria was taken, and its library, then the most valuable in the world, burned. This was considered an act of vandalism which had few, if any, parallels in history.

Egypt was governed by Mohammedan viceroys, and remained a province of the Saracen Empire for the next two centuries. The Coptic faith was superseded by Islamism, and Egypt gradually changed from a Christian to a Mohammedan country.

A new Arab state was in process of formation in the North of Africa. They called themselves Fatimites, and renounced the authority of the Caliph of Bagdad. They conquered Egypt, and ruled the country for two centuries.

During the reign of Caliph Adhed, A. D. 1171, the last of the Fatimite line, civil war broke out, which was terminated by the assistance of the Sultan of Damascus. One of his generals was appointed Grand Vizier of Egypt, but died after holding the position two months His nephew, Saladin, surnamed the Great, succeeded as ruler, and eventually proclaimed himself Sultan of Egypt and Syria.

It was during the reign of Saladin that the third crusade was undertaken. In 1517, the

Turks, under Selim I., conquered Egypt, and placed a viceroy, or pasha, at the head of the administration. They governed the country for two centuries, during which it declined in population and wealth.

The French, under Napoleon Bonaparte, invaded Egypt in 1798. They defeated the Egyptians in a great battle at the Pyramids, and, notwithstanding the assistance rendered the latter by an English naval force under Nelson, they made themselves masters of the entire country within a year.

On the return of Napoleon to France, in 1799, he deputed General Kleber to hold the country. He, however, was soon assassinated, and his successor was defeated at Canopus by the combined English and Turkish forces, under General Abercrombie. The French evacuated Egypt in 1801, and the country was restored to the dominion of the Sultan.

The exploits of Mehemet Ali next attract attention. He was a native of Macedonia, and having won distinction in the Turkish armies he was appointed Pasha of Egypt. His design was to secure the country for himself, as an independent hereditary government, and to this end he became engaged in a war with Turkey, which he prosecuted with such success that Constantinople would have fallen before him but for the interference of the European Powers, who compelled him to accept a settlement confirming him in his power as viceroy and tributary to the Sultan.

He made a second attempt at independence in 1839, which again caused the intervention of the European Powers, and resulted in a treaty by which Egypt was confirmed to Mehemet Ali and his successors in a direct line, and the payment of an annual tribute to the Sultan was exacted.

He was succeeded by his son Ibrahim in 1848, on whose death, in the same year, Abbas Pasha, his nephew, became viceroy of Egypt.

His administration was marked by cruelty and narrow-mindedness, and he is supposed to have been assassinated.

He was succeeded by Said Pasha, fourth son of Mehemet Ali. Prudence and good judgment characterized all his public actions. He made many internal improvements, and the impetus which he gave to the construction of the Suez Canal caused one of its terminal points (Port Said) to be named in his honor.

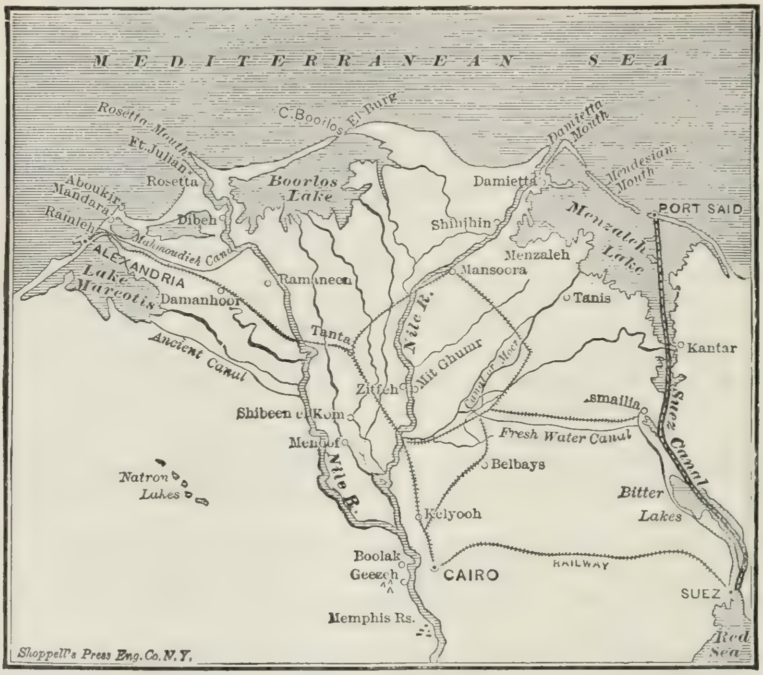
Ismaîl Pasha, his nephew, succeeded him in 1863. He instituted many reforms, fostered industries, and improved public education; but he lavished money with such prodigality that financial ruin seemed the legitimate outcome.

In November, 1875, he turned to England for assistance in his pecuniary difficulties, and, on an investigation being made, he was deposed, had to leave Egypt and take refuge in Italy.

During the administration of Ismail the title of Pasha was changed to Khedive, which implies a higher authority. He invited the sovereigns of Europe to assist at the celebration of the opening of the Suez Canal in 1868. The canal, which is one hundred miles long, was constructed by M. de Lesseps, a French engineer, at a cost of $100,000,000.

In 1879, Tewfik Pasha, the eldest son of Ismail, was made Khedive. To secure the payment of Egyptian indebtedness, Turkey placed the revenues in charge of Europeans, mostly French and English, who were free from taxes and with large salaries, which caused discontent among the Egyptians, on whom the burden of taxation rested heavily. A riot occurred in Alexandria in June, in which many foreigners were massacred. Arabi Pasha, the Khedive's general, revolted. England requested the restoration of order. Turkey evaded compliance. Arabi Pasha hesitated to discontinue the further fortification of Alexandria until after the time specified, but finally agreed to dismantle the forts. Seymour, the British admiral, said the offer came too late, and he opened fire on the Egyptian forts, which were completely silenced in two hours.

A fire broke out that burnt a large portion of the city. Arabi, with 20,000 men, mostly undisciplined troops, was defeated by General Wolseley, with 15,000 soldiers, in an early morning attack, Sept. 13, at Tel-el-Keber. Nearly 60,000 Egyptians surrendered within a few days after, and Arabi surrendered at Cairo. The English forces still remain in Egypt ostensibly to maintain order. In 1883, the people of the lately annexed province of the Soudan, inspired by their false prophet, El Mahdi, arose in rebellion against Egyptian rule. General Gordon was sent from England to take command, and several battles have been fought with varying success.



WAR MAP OF EGYPT.

CARTHAGE.

Carthage was founded by Dido, an ex-queen of Phœnicia, about 880 B. C. The city was located on the north coast of Africa, near the present city of Tunis. Dido was accompanied by a colony of rich Tyrians, who fled from a democratic revolt in Phœnicia, in which the king was killed.

A monarchy was the first form of government, which in time gave place to a republic, in which two chief magistrates, called *suffietes*, or judges, were annually elected.

The government of Carthage, while a republic, is spoken of by Aristotle as one of the most perfect of antiquity, and under it the country flourished and extended its dominions.

Having gained wealth by an extensive commerce, the Carthaginians made conquests and founded colonies which proved sources of great revenue. They had possessions in many parts of Africa, also in Spain, Sicily, Sardinia, and a few islands in the Mediterranean. In the height of her power she was mistress of the sea, but her soldiers mainly consisted of mercenaries.

As Carthage has left nothing in literature, science, or art to mark her greatness, the only things which give her historical importance are her wars with the Romans, termed Punic wars, from *Pœni*, the Latin form of the word Phœnicians.

The first Punic war (264–241 B.C.) was occasioned by the Mamertines, mercenary marauders from Campania, getting the assistance of the Romans in a war with Hiero, king of Syracuse. The Carthaginians allied themselves with the Syracusans. They were beaten by the Romans, and Agrigentum, the most important Carthaginian naval *depot*, captured. The Romans, under Regulus, "carried the war into Africa" and took Tunis. He was, however, finally beaten and captured by Xanthippus, a Lacedæmonian, who commanded the Carthaginians.

The war was for some years carried on, mostly at sea, where a decisive victory was obtained by Lutatius, the Roman admiral, which made the Romans masters of the ocean.

After their defeat by the Romans, the Carthaginians, under Hamilcar, extended their conquests in Spain. He made his son, Hannibal, at the age of nine years, swear eternal enmity to Rome. Hasdrubal, the son-in-law of Hamilcar, built the city of Carthagena in Spain, and when Hannibal succeeded him in command he took the city of Saguntum, then under Roman protection, which gave rise to the second Punic war (218–201 B.C.).

Hannibal crossed the Alps and carried the war into Italy, where he was victorious in the important battles of Trebia, Trasimenus, and Cannæ.

The Carthaginians were expelled from Spain by Scipio, who afterwards invaded Africa, where his success necessitated the recall of Hannibal from Italy. On his return he was defeated at Zama, and a peace concluded by which Carthage was to give up her foreign possessions and pay tribute to Rome.

Fifty years from the close of the second Punic war Carthage began to exhibit traces of its previous splendor. Rome, jealous of the growing power of its former rival, precipitated another war on the pretext of a slight dispute between the king of Numidia, a Roman ally, and the Carthaginians. After sustaining a siege of three years, Carthage capitulated and was reduced to ashes. Thus ended (146 B.C.) the third Punic war, and with it the existence of a city which had flourished for 700 years, and contained at one time 700,000 inhabitants.

MOROCCO is a country situated in the extreme northwestern part of Africa, bounded on the east by Algeria, on the south by the Desert of Sahara, on the west by the Atlantic Ocean, and on the north by the Atlantic and the Mediterranean Sea. Its area is about 219,000 square miles, with a population of 5,000,000, the greater portion being Moors, and the remainder consisting of Bedouins, Jews, and negroes.

The greater portion of the interior is unknown to Europeans. The government is an absolute monarchy. The Sultan, Muley-Hassan, under the title of Emir-al-Mumenin, or "Absolute Ruler of True Believers," the thirty-fifth lineal descendant of Ali, the uncle of Mahomet, is both temporal and spiritual ruler. There are eight ports open to foreign commerce, but the exports do not exceed $2,000,000 in value.

ABYSSINIA has an area of about 200,000 square miles, with a population of 4,000,000. It consists of irregular plateaus from six to eight thousand feet above the sea level. Accordding to early traditions, it was ruled by the Queen of Sheba, from whom the subsequent kings claim to be descended. No commercial relations are had with it at present on account of the difficulty of reaching it, and the danger from the barbarous tribes between it and the Red Sea. It is a fertile country, and presents the possibility of future commercial interest. Its present ruler is called King John.

EUROPE

EUROPE is the smallest of the great divisions of the Eastern Hemisphere, having an area of about 3,800,000 square miles. As a political division, it is an offshoot of the despotisms of Asia; yet, from the very beginning of its history, we see manifested that spirit of freedom which has ever been a distinguishing characteristic of its peoples, in contrast with the sycophantic, abject servility of the peoples of Africa and Asia. It is the birthplace of the spirit of individual freedom, although many of its nations have been, and some now are, under despotic rule.

In certain cases, the very excess of freedom has been the basis of a despotism; yet, at no time since the Hellenes settled the peninsula now known as Greece has that divine leaven, of whose workings American institutions are the perfected result, ceased to manifest its presence.

In Europe has been developed, or out of it has come, all that is best, most glorious, and most desirable in the history of mankind.

Beginning with the brilliant opening of authentic Greek and Roman history, there has been a constant advance toward the highest form of civilization; yes, even through the intermediary period of the so-called Dark and Middle Ages, which was absolutely necessary to infuse a vigorous feeling of individuality and personal responsibility into the generally languid, luxurious, effeminate inactivity, resulting from excess of pride in, and dependence upon, the national name and power.

The result of this increasing love of individual liberty was the formation of many small, independent communities, which finally became united into great nations by oneness of feeling and language, and need of combination for the protection of their common interests.

The principal resulting nations now are, —

Great Britain and Ireland, France, Germany, Russia, Italy, Spain, Austria-Hungary, Greece, Turkey, Holland, Belgium, Portugal, Denmark, Sweden and Norway.

These nations of Europe, individually and collectively, control the destinies of most of the nations of Asia and Africa. Hence Europe is in every respect at present the most important division of the globe.

In subsequent pages will be found an outline of the history of each of the countries named, consequently a further general description is not required.

We will mention, however, two recently created kingdoms of which special description is not elsewhere given; viz., Roumania and Servia; also the principality of Montenegro.

Roumania was created by the union of the principalities of Wallachia and Moldavia, and was declared independent of Turkey, May 21, 1877, and its independence was confirmed by the Congress of Berlin, July 13, 1878. Karl I., the present ruler of this constitutional monarchy, was proclaimed king of Roumania, March 27, 1881. He had previously represented the head of the government from 1866, under the title of Prince Karl I.

Roumania is bounded on the south by the river Danube, on the west and north by the Carpathian Mountains, and on the east by the river Pruth and the Black Sea. Its area is about 48,000 square miles, with a population of 5,290,000, principally adherents of the Greek Church. The exports in 1880 amounted to $7,309,080, consisting chiefly of wheat, barley and corn; and the imports amounted to $5,563,805. The capital is Bucharest.

SERVIA gained virtual independence of Turkey in 1829, and has subsequently been under the rule of princes, until entire independence was established by the Treaty of Berlin. Prince Milan was declared King Milan I., of Servia, by the National Assembly, March 6, 1882.

Servia is bounded on the south and west by Turkey and Bosnia, on the east by Bulgaria and Roumania, and on the north by Austria-Hungary. Its area is about 16,600 square miles, with a population of 1,700,211, chiefly adherents of the Greek Church. The capital is Belgrade. The chief article of export is live animals, the total amounting annually to about $5,500,000.

MONTENEGRO is a principality having the executive power in the hands of a prince, and the legislative power in a council of eight members, one half of whom are nominated by the prince, and the other half elected by the people. The virtual independence of this state was established by Petrovic Njegos, who became Vladika or prince-bishop in 1697. The present Constitution of the country was proclaimed in 1879. The present ruler is Nicholas I. The area of Montenegro is 3,550 square miles, with a population of 250,000. The people belong to the Servian branch of the Sclavonic race, and are adherents of the Greek Church.

GREECE.

The history of Greece is not so much the history of any particular kingdom, as of a number of independent states, sometimes at war and sometimes in alliance with each other. There is only a fabulous history of the early kingdoms of Greece, and the transactions of their monarchs have not been recorded in a trustworthy manner.

Sicyon, the most ancient kingdom, was founded 2089 B. C. by an Asiatic people named the Hellenes, and the kingdom of Athens was first established by Cecrops, 1556 B. C. The Trojan war commenced 1173 B. C. The beautiful, but disloyal, wife of Menelaus, king of Sparta, occasioned this memorable war between the Greeks and Trojans, which ended in the downfall of Troy. Corinth became a kingdom at a later period than any of the other cities. The kingdom of Macedon was raised by Philip, and his warlike son, Alexander, to the highest pitch of glory; and it existed, with varying fortune, from that period till the defeat of Perseus by the Romans, a space of 626 years.

The regal government prevailed in the early period in all the states of Greece, but in process of time the injustice of usurpers, and the severity of masters towards their slaves, occasioned insurrections and brought a change, from which Macedonia alone was exempt. The republican form of government became generally adopted, with almost as many forms as there were different cities; but notwithstanding the diversity of their laws, customs, and interests, the states of Greece were united by one common language and religion, by the celebration of public games at which they all assisted, and particularly by the Amphictyonic Council, which met every year at Thermopylæ.

In this way the Greeks formed one political confederacy, by which they were enabled not only to resist, but even to defeat and completely to disperse the largest armies of Persia, chasing them from the country, and compelling them to make peace.

Sparta, or Lacedæmon, and Athens figured most prominently among the Grecian states, and acquired a sort of superiority over the rest. These, therefore, naturally occupy more space in history than the others.

The first opportunity which the Spartans had to display their superiority over the neighboring states was in the war with the Messenians, which continued twenty years, and ended favorably to Sparta.

In the eighth century Lycurgus furnished the Spartans with a code of laws. The Athenians were also desirous of being governed by a written constitution, and applied to Draco, a man of undoubted integrity and wisdom. The severity of the code drawn by him defeated its execution, and the republic sank into anarchy till Solon, one of the wise men of Greece, became legislator. The laws introduced by Solon effected a general reform; but during his absence of ten years the former abuses were revived, and soon after his return Pisistratus assumed the supreme power, which, though twice banished, he retained till his death.

Hippias, one of his sons who succeeded him, upon being driven from his dominions, applied for assistance to Persia. Athens was asked to reinstate its former sovereign, but refused; upon which Darius, the Persian ruler, invaded Greece. Previous to the invasion, however, he sent two heralds, demanding earth and water (the usual tokens of submission), to Athens and Sparta; but the inhabitants threw the one in a ditch, and the other in a well, and bade them "take their earth and water there."

The invasion then began, with a numerous army and very large fleet. When the invaders advanced to the Plains of Marathon, near Athens, Miltiades, with 10,000 Athenian warriors and some troops gathered in Platæa, defeated the Persian army, and took some of their ships and set others on fire, 490 B. C.

Xerxes, the successor of Darius, continued the invasion of Greece, with an enormous army and immense fleet; he approached Thermopylæ (a narrow pass twenty-five feet broad), defended by Leonidas, a Spartan prince, with a chosen band of 6,000 men, and sent a summons for unconditional surrender; but Leonidas treated the summons with contempt, and when he was assured that the darts of the Persians were sufficiently numerous to darken the sun, he calmly replied, "Then we will fight in the shade."

Leonidas repulsed the assault for two days with dreadful slaughter; but on the third day, a traitor having led the enemy by another pass to the rear of the forces of Leonidas, his chosen band was finally destroyed, but not until they had slain thousands of their foes.

About the same time thirty Persian vessels were taken or sunk by the Grecian fleet. Xerxes, having passed Thermopylæ, hastened to Athens, took and reduced the citadel to ashes; but news came that at Salamis the Persian fleet was defeated and entirely dispersed, whereupon Xerxes hastened back to the Hellespont, where, finding his bridge broken down, he was obliged to recross in a small fishing-boat, — a circumstance which contrasted strongly with his pompous entrance into Europe, 480 B. C.

In the following spring the Persian general, Mardonius, lost a battle and his life, near the city of Platæa, in Bœotia, and his army, vastly superior in numbers, was defeated by the Greeks with great slaughter. This victory, and another on the same day over the Persian fleet at Mycale, was obtained by the confederate Spartan and Athenian forces, led respectively by Pausanius and Aristides.

No sooner were the Greeks delivered from the invading foe than a misunderstanding, relative to the rebuilding of Athens, took place among themselves. The black cloud of civil war, however, was happily dispersed by the prudence of Themistocles and Aristides;

and the confederates turned their attention to an expedition, which resulted in the emancipation of all the cities of Cyprus from the Persian yoke, and the capture of the city of Byzantium, with immense treasures. The wealth thus acquired contaminated the purity and simplicity of manners for which the Greeks had hitherto been celebrated.

Pausanius, who had led the brave troops of Greece in the battle of Platæa, was now convicted of treason; and Themistocles, who was accused of being privy to the treachery, was banished.

Aristides, however, acquired the most brilliant reputation by his integrity and love of justice, and at the time of his death, notwithstanding that he had for a length of time the public treasures at his disposal, did not leave money enough to defray the expenses of his own funeral.

Cimon, the son of Miltiades, a man of great wisdom and probity, in an expedition into Persia, won a signal victory over the Persians, both by sea and land, 469 B. C., and made them submit to a peace by which it was stipulated that the Greek cities in Asia should be left in the full possession of their liberties, and that no Persian force should approach within a certain distance of the Grecian coasts. The immense treasures which Cimon acquired were expended in beautifying his native city.

Ancient Athens.

Athens had now reached the height of her power and glory. It had at this time a population of about 200,000. The public buildings and temples were magnificent, and the city was the home of philosophy and the sciences.

The rising influence of Pericles, who also labored to adorn Athens, was inimical to that of Cimon, and the illustrious warrior was banished by his ungrateful countrymen; but after five years Cimon was recalled from his unmerited exile, and died in a war against Cyprus. Pericles for some time retained such complete ascendancy over the people that he may be said to have possessed almost sovereign power in a free state. He died 429 B. C.

The Peloponnesian war, which began in 431 B. C., between Sparta and Athens, and involved the other states of Greece, was temporarily concluded by the Peace of Nicias, 421 B. C. Notwithstanding this treaty, the flames of war were soon rekindled between these republics on account of their allies, and fanned by Alcibiades, who was then the most popular man among the Athenians, to gratify his ambition. Several dreadful engagements ensued, by land and sea; and the balance of victory appeared to waver, though the arms of Sparta were eventually successful. Alcibiades was deprived of the command of the army and banished. The Athenians, being repeatedly defeated, were destitute of money, ships, and mariners, and were obliged to submit to the demolition of their fortifications and to conclude a treaty with the Spartans, which finally ended (403 B. C.) the Peloponnesian war, the longest and most sanguinary in which Greece had ever been engaged.

An event as unfortunate for Athens as the demolition of her walls was the change of her government, for the Lacedæmonians left the supreme power to thirty aristocratic Athenians, known by the name of the "Thirty Tyrants." Imprisonments, murders, and confiscations followed. At length, however, after the expulsion of the tyrants, the Athenian government was re-established upon its ancient footing.

The expedition of the Greeks, under Cyrus, against his brother, Artaxerxes, was a great undertaking, and the retreat, under Xenophon, after the battle of Cunaxa, is the most celebrated in history; the distance passed in going and returning was 1,150 leagues, or about 3,450 miles, and the time, including rest, fifteen months.

In Athens, Socrates, one of the greatest philosophers and most exalted characters that ever lived, had been long proscribed by a faction that hated him for his avowed detestation of everything which he deemed inconsistent with the principles of honor and justice. He had formerly been exposed to ridicule on the stage, but now he was accused of the capital crimes of rejecting the gods and corrupting the youth of Athens. Upon these charges, though utterly groundless, Socrates was condemned to drink the juice of hemlock, which he did with the most unshaken fortitude, in the seventieth year of his age. Shortly after his death, however, the Athenians were so deeply affected by the sense of their injustice that they erected a statue of excellent workmanship to the memory of the deceased philosopher.

On the downfall of Athens, Sparta, under Lysander, took control in the affairs of Greece (the other states furnishing their quota to the Spartan armies), and Agesilaus, soon after chosen leader of the Spartan forces, obtained several victories over the Persians; but the other Grecian states revolted, and attacked Sparta, and Agesilaus, influenced, it is said, by gold, concluded a treaty with Persia, dishonorable to all Greece, whereby all the Grecian provinces in Asia were ceded to Persia.

A war between Sparta and the Thebans broke out 379 B. C. The latter, under the command of Epaminondas, obtained, though at the expense of his life, a decisive victory at Mantinea, 362 B. C., and a peace was concluded, which the Grecian states, with the exception of Sparta, expressly ratified.

In the mean time a power was growing up in Greece hitherto unobserved, but now conspicuous and important. This was the state of Macedonia, whose king, Philip, won several victories, with the aid of his famous phalanx, against the Grecian states, and finally conquered them all.

Demosthenes.

In Athens, the leader of the people was Demosthenes, perhaps the world's most finished orator, who used all his ability and influence against Philip, but without avail. Philip was assassinated by a Macedonian of high rank, and Philip's son, Alexander, succeeded to the throne, 336 B. C. This king was surrounded by dangers from the Greeks and other nations; but he was fearless, and planned to conquer the world. His brilliant victories in Greece, Persia, Syria, Egypt, and many other countries gave him the name of "the Great."

Alexander founded the city of Alexandria in Egypt, and on visiting the Temple of Jupiter Ammon, in Lybia, the priest addressed him as the son of the god, which Alexander thenceforth assumed to be his parentage. He married Roxana, daughter of King Axertes, carried his arms into India, which he subdued, and arrived at the Indian Ocean. Here, casting his eyes on the broad expanse of waters, he wept at the idea of there being no more worlds for him to conquer. On reaching Susa, in 325 B. C., he contracted two more Asiatic marriages. The death of his friend Hephæstion, the commander of his horse guards, made a deep impression on Alexander's mind, and he sought a remedy in the most unbounded intemperance, which probably aided the fever that terminated his existence in the thirty-third year of his age and the thirteenth of his reign.

On his death the crown was placed on the head of Aridæus, his illegitimate brother, but Roxana gave birth to a son, who was named Alexander, and shared the sovereignty under a regent.

After a variety of commotions, Alexander's principal captains assumed the titles to that sovereign power of which they had, in fact, been long possessed. Ptolemy was declared king of Egypt, Cassander king of Macedon, and Lysimachus and Seleucus took the same badge of royalty in the provinces of Bithynia and Thrace and Babylon.

In the mean time the young Alexander and Aridæus were murdered, and scarcely twenty-eight years had elapsed from the death of Alexander the Great when every branch of his family was extinct.

The Grecian states then became torn by various revolutions and quarrels between the different states, which paved the way for the invasion of Macedon by the Romans, who immediately reduced Macedon to a Roman province, and soon afterwards annexed all the other states of Greece to the immense Roman Empire.

Greece remained under the control of the Romans till the division of the Roman Empire, A. D. 395, when it formed part of the Byzantine or Eastern Empire, and remained as such until it was conquered and divided by the Latin princes in the eleventh century.

The Turks subdued Greece in the middle of the fifteenth century, and it remained under the control of the Turkish Empire till 1827. For five years previous the Greeks had been bravely battling for their independence. On Oct. 20, 1827, was fought the great naval battle of Navarino, when the combined squadrons of England, France, and Russia defeated the Turkish fleet, which practically gave Greece her independence. Her condition since has been peaceful and fairly prosperous. Practically a peninsula, with several small islands, her territory is about the same size as that of Ancient Greece. With the ruins of her principal city, Athens, and other places deservedly admired for the style of their architecture, and with a population of 1,700,000, she sits to-day in the shadow of her former greatness.

ROME.

The early history of Rome, like that of most other ancient nations, is so mixed with fable and traditionary tales that it cannot be received as perfectly reliable. According to the poets, Æneas, a prince of Troy, who fled from the destruction of that city, settled on the shores of Italy, married the daughter of Latinus, king of Latium, and finally became his successor.

Mythology tells us that Rhea Sylvia, daughter of Numitor, — fifteenth king in a direct line from Æneas, — was the mother of the twin brothers, Romulus and Remus. They were left to perish, but were nursed by a wolf till one Faustulus found them and brought them up as his own children.

After having selected a site for the building of a city, Romulus slew his brother Remus for having in derision jumped over its walls. The city which he then commenced to build on the Palatine Mount on the river Tiber, 752 B. C., was called Rome, from the name of its founder. Romulus was invested with the regal title and authority, and in order to increase the number of inhabitants he made the city an asylum for fugitives. He also invited the Sabines, a neighboring people, to a festival, during which he directed the young Romans to carry off the Sabine women for wives.

Romulus divided his people into two orders: the patricians, or those who had a noble or free ancestry; and the plebeians, who were subject to the king and patricians. His reign, on the whole, was marked by the enacting of wise laws, well adapted to a newly formed state.

During the reign of Romulus the Sabines and Romans became united as one people, and on the death of the king, Numa Pompilius, a Sabine was elected to the throne. During his long and peaceful reign of forty-three years, he regulated the civil and religious institutions of the Romans, divided the year into twelve months, and built the temple of Janus, which was to be kept open only in time of war.

Tullus Hostilius, the third king of Rome, was of a warlike disposition. He got into a quarrel with Alba-Longa, a Latin city. It was arranged to decide the difficulty by a contest between the Horatii (three brothers in the Roman ranks) and the Curatii (three brothers in the Alban army), sons of two sisters. The Curatii were slain, and one of the Horatii survived, by which victory the Romans became masters of Alba. Having excited the anger of Jove, Tullus Hostilius was struck by a thunderbolt in the thirty-third year of his reign, and was succeeded by

Ancus Martius, the grandson of Numa Pompilius. He extended the Roman territory to the sea, and established the colony of Ostia, at the mouth of the Tiber. He reigned twenty-four years, and died 616 B. C.

Tarquinus Priscus, his successor, adorned Rome with many elegant buildings, laid the foundation of the Capitol, and after reigning with great popularity about thirty-eight years, was assassinated 578 B. C. by two of his former wards whom he had deprived of the crown.

Servius Tullius, the sixth king of Rome and son-in-law of Tarquin, secured the crown mainly through the intrigues of his mother-in-law. He established the census, beautified and enlarged the city, and enclosed the seven hills within a stone wall.

Tarquinus Superbus, or Tarquin the Proud, caused the assassination of his father-in-law, Servius, and thus usurped the throne as the seventh and last king of Rome. He became odious to the Romans by his haughtiness and tyranny; and the insult offered Lucretia, a noble Roman lady, by his son Sextus, caused the expulsion of Tarquin from Rome and the assassination of Sextus.

This ended the rule of the kings, and a republican form of government was established, the people annually electing two magistrates called consuls, the first of whom were Brutus and Collatinus, the former the defender of Lucretia, and the latter her husband.

The Tarquins made several attempts to recover the throne, during which a dictator was appointed by the Roman Senate, who was invested with temporary despotic power. Under the dictatorship of Posthumius the Romans were completely victorious and the sons of Tarquin slain.

After the lapse of a few years, Rome again became the scene of anarchy and commotion, on account of the unjust exactions of the patricians. The people, driven to desperation, forced the Senate to give them the right of choosing five magistrates, called tribunes, who should have the power of vetoing every measure prejudicial to plebeian interests.

Meanwhile a scarcity of provisions ensued, and Coriolanus, a haughty and valorous patrician, proposed that no corn should be distributed to the people except on condition that they abolished the office of the tribunes, in consequence of which he was tried and sentenced to perpetual banishment. The number of the tribunes was afterwards increased to ten.

About this time (456 B. C.), owing to the invasions of the Æquians and Volscians, and the dissensions arising from a proposed agrarian law (that is, a law relating to land), Cincinnatus was twice called from the plough to assume the office of dictator. He succeeded in vanquishing the enemies of his country, and retired again to the labor of his farm.

The Romans had up to this time no written code of laws, and the decisions of their kings and consuls were often so arbitrary as to cause grievous complaint. They therefore sent three commissioners to Athens to get the laws of Solon, that such of them might be adopted as were suitable for the Roman republic. On the return of the commissioners, ten persons, called Decemviri, were elected as legislators, and invested with absolute authority for one year, during which time all other magistrates were suspended.

The Decemviri having framed the proposed laws, they were ratified by the people, engraved on blocks of wood or ivory, and placed in the Forum (a large, open space surrounded with porticos, in which the people assemble, to discuss and transact public business).

The Decemvirs, on being appointed for a second year, became tyrannical, and Appius Claudius, the leading member of their body, having sought to secure the lovely maiden Virginia as his mistress, so incensed the people that the Decemvirate was abolished, and the consuls and tribunes restored.

In the year 390 B. C., the Gauls (a hitherto unknown people) invaded Italy under the command of Brennus. They besieged the citadel, which, however, was saved by the cackling of some geese awakening the sentinels. The Gauls pillaged and burned the city, and retired to their own country laden with spoils. The city, however, was soon rebuilt, and the offices of prætor and ædile created, the former to inspect public buildings, and the latter to administer justice.

Shortly after this period a new host of invaders appeared in the Samnites, a hardy race inhabiting the southern part of Italy. After a contest lasting upwards of fifty years, they were finally subdued.

For five centuries the Romans remained within the limits of Italy, usually engaged in warfare with neighboring states.

Pyrrhus, king of Epirus, made a descent upon Italy, 280 B. C., and his defeat inspired the Romans with a thirst for foreign conquest. They considered the acquisition of Sicily a most desirable object, and the effort to secure it brought them in contact with Carthage, then the richest and greatest maritime power in the world. After a prolonged struggle the Carthaginians were beaten, and Sicily became a Roman province. (For an account of the Punic wars, see history of Carthage.)

The ambition of the Romans after the defeat of the Carthaginians was unparalleled, and, elated by success, they aspired to universal dominion. While engaged in hostilities with the Carthaginians, the Romans proclaimed war against Philip of Macedon, which resulted in the defeat of the latter at the battle of Cynocephalæ.

Antiochus the Great, king of Syria, was next subdued by the Roman legions; and soon afterwards, Perseus, king of Macedon, refusing to submit to the conditions imposed upon his father, Philip, was defeated at the battle of Pydna, and his kingdom became a Roman province, 168 B. C.

Shortly after these events, the third Punic war terminated with the complete destruction of Carthage, 146 B. C. Corinth was taken and burned, Greece became a Roman province, and the subjugation of Spain and the Numantines added new lustre to the arms of a people who in one century extended their conquests over most of what was then known of Europe.

As the Romans conquered the smaller states of Italy, they took into their possession a portion of the conquered lands, and for their equitable distribution various statutes were passed under the name of Agrarian laws, which enacted that no citizen should possess more than five hundred acres. It was therefore customary to sell a part of the new territories by auction, and to divide the rest among the poorer citizens on the payment of a trifling quit-rent to the treasury. But the wealthy citizens purchased numerous small portions of land from the indigent owners, and thus gradually acquired, in violation of the provisions of said laws, such an extent of territory as threatened the industrious husbandman with ruin.

During this state of affairs the famous tribune, Tiberius Gracchus, advocated the claims of the people, demanded the restitution of the alienated lands, and the immediate execution of the old Licinian or Agrarian law. This occasioned a civil war in which the noble advocate of an injured people fell a victim to an avaricious Senate.

Caius Gracchus then came forward as the brave opposer of oppression, but his exertions proved unavailing, and he shared the fate of his unfortunate brother, 121 B. C.

The Jugurthine, or Numidian war commenced 111 B. C. Jugurtha, who had usurped the crown, was starved to death in the Mamertine prison, and Numidia and Mauritania were annexed to the Roman Empire.

Soon afterwards war was declared against Mithridates, king of Pontus, during which Sylla commanded the Roman armies. The Pontic king was defeated, and peace restored on condition that he should give up his conquests and his fleet.

On the return of Sylla to Italy the flames of civil war were kindled on account of the enmity between him and the Consul Marius. Sylla triumphed over his opponents, whom he treated cruelly, and assumed perpetual dictatorship, but voluntarily resigned some time before his death.

The Servile war brought about by Spartacus, the gladiator, formerly a Thracian shepherd, harassed the commonwealth for two years, till Spartacus and his band were defeated by Crassus, 65 B. C.

The famous conspiracy of Cataline to murder the consuls and overthrow the government was exposed by Cicero, the great Roman orator. The conspiracy was quelled and Cataline slain.

Cæsar, Pompey, and Crassus, at this time the most distinguished Roman generals, formed what is known as the First Triumvirate. Cæsar conquered Gaul and planted the Roman standard on the shores of Britain. His subsequent victory over Pompey on the Plains of Pharsalia (48 B. C.) left him master of Rome. Pompey, who retired to Egypt, was assassinated, and the Roman Senate was so stripped of its powers that scarcely a vestige of republican government remained.

Cæsar ruled with clemency, and his rapid conquests enabled him, in two years after coming into power, to prescribe laws to the known world. But Brutus, Cassius, and other conspirators murdered him in the Senate House (44 B. C.), claiming that he was a usurper, had subverted a free government, and aspired to be crowned as king or emperor.

Cæsar's grand-nephew, Octavius, and his friends, Mark Antony and Lepidus, seized the government, formed the second Roman Triumvirate, and divided the provinces among them.

Bust of Cæsar.

Brutus and Cassius, who fled to Thrace after the murder of Cæsar, wished to restore the commonwealth, and raised an army for that purpose, but were defeated by Antony and Octavius near Philippi.

Harmony did not exist long in the Triumvirate. Lepidus was banished, and Antony, who went to settle a dispute with Cleopatra, queen of Egypt, became enslaved by her beauty, and abandoned himself to pleasure and indolence. A civil war ensued, in which Antony was defeated in a great naval battle near Actium, Egypt was reduced to a Roman province, and Octavius became complete master of the Roman Empire.

Octavius assumed the titles of Augustus and Emperor. The whole civilized world, consisting of what is now called France, Italy, Spain, Portugal, Switzerland, Belgium, Greece, Turkey (both in Europe and Asia), Egypt, also all the northern parts of Africa, were under the dominion of Rome.

Augustus proved a wise and prudent monarch. He was the patron of arts and letters, framed salutary laws, and frequently conversed with Virgil, Horace, and other learned men of his time. His reign is termed the golden period of Roman literature.

On the death of Augustus, A. D. 14, the government devolved upon his adopted son, Tiberius, who commenced his reign with clemency and ended it with tyranny. He died A.D. 37, in the twenty-third year of his reign.

Caligula, the successor and grand-nephew of Tiberius, was a cruel and detestable ruler. The philosopher Seneca says of him that " nature seemed to have brought him forth to show what was possible to be produced from the greatest vice supported by the greatest authority." He was assassinated in the fourth year of his reign, and was succeeded by his uncle, Claudius, who made an expedition into Britain, and carried Caractacus, a British king, captive to Rome. Claudius was poisoned, in the fourteenth year of his reign, by his empress, Agrippina, who wished to raise Nero, her son by a former husband, to the throne.

The beginning of Nero's reign was marked by acts of kindness, but soon his mother, his wives, and the celebrated writers, Seneca, Lucan, Burrhus, and others, were murdered at his command. He is said to have wantonly caused Rome to be set on fire that he might have a representation of the burning of Troy as described by Homer, and to have stood upon a high tower that he might enjoy the scene. He afterwards charged the crime upon the Christians, against whom he commenced a most cruel persecution, in which St. Paul was beheaded.

A conspiracy was at length successfully formed against the tyrant by his general, Galba, who commanded in Spain, and who succeeded in having himself proclaimed emperor. Nero in a certain sense evaded the punishment of his crimes by an act of suicide in the thirty-second year of his age and the fourteenth of his reign.

From the death of Nero till the accession of Constantine, few events of striking historical importance occurred.

Constantine I., called the Great, transferred the imperial seat from Rome to Byzantium, which he enlarged and beautified and called Constantinople (Greek, πόλις, a city, — the *city of Constantine*). He openly professed Christianity, and established it as the religion of the state; and he also convened and attended the General Council of Nice (A. D. 325), at which the doctrine of the Trinity was defined. He died A. D. 337, in the thirteenth year of his reign.

On the death of Constantine, his three sons, Constantine II., Constantius, and Constans, had the empire divided amongst them. They became involved in civil war, in which Constantine and Constans were slain, leaving Constantius sole ruler, who was succeeded by Julian, surnamed the Apostate, from his having forsworn Christianity for Paganism.

Afterwards, during the reign of Theodosius the Great, the Huns and Goths were severely chastised for invading the Roman provinces.

The final division of the imperial dominions took place between Arcadius and Honorius, the sons of Theodosius. Arcadius assumed the government of Thrace, Asia Minor, Syria, and Egypt, from the Lower Danube to the confines of Persia, and Ethiopia, with Constantinople, the capital, and was the acknowledged ruler of the Eastern Empire. Honorius reigned over Italy, Africa, Gaul, Spain, and Britain, which formed the Western Empire, with Rome as the capital. During the reign of Honorius, Alaric, king of the Goths, ravaged Italy and plundered Rome, and Attila, king of the Huns, in this and the succeeding reign of Valentinian III., devastated Lombardy, and was about to attack Rome, when a peace was negotiated through the instrumentality of Pope Leo I.

The frail edifice of the empire now rapidly approached its dissolution. Genseric, king of the Vandals, waged war against Rome for over twenty years, during which eight emperors were successively raised to the throne. Africa was seized by the Huns, Gaul by the Franks, Great Britain by the Saxons, and Spain by the Goths, Alans, and Suevi; while Odoacer, a German chief, conducted the Heruli, Turcilingæ, etc., into Italy, A. D. 476, and compelled Augustulus, the last emperor of the West, to resign the crown. Odoacer assumed the title of king of Italy, and thus ended the existence of the Western Empire.

The duration of the Eastern Empire extended from the year 395 to 1453, when Constantinople was taken by the Sultan, Mahomet II., who established the Turkish Empire on the ruins of this once splendid, but now subverted, monarchy.

GOTHS, VANDALS, AND HUNS.

The Goths were first known in history as Gothi, or Gothones, a Teutonic people occupying the Prussian coast of the Baltic Sea, near the mouth of the Vistula River.

At the beginning of the third century they migrated to the northwestern shore of the Black Sea, and in 249 took possession of Dacia, a Roman province. In 272 they had separated into two divisions, the one occupying Mœsia and Pannonia being called Ostrogoths (East Goths), and the other, Visigoths (West Goths), who had settled north of the Danube.

In 410, the Visigoths, under Alaric, overpowered and plundered Rome, and subsequently settled permanently in the southwest of Gaul, having their capital at Tolosa. They sent an expedition into Spain, founded a kingdom there, and held possession for two hundred years, until overthrown by the Arabs in the eighth century.

The Ostrogoths, under Theodoric the Great, took possession of all Italy in 493, and held it until conquered by Narses, a general of Justinian, in 553. A colony of the Goths occupied Scandinavia until it was united to Sweden under Charles Swerkerson in 1161. The Goths were the first Teutons to come under the influence of Christianity in the form of Arianism.

The Vandals, or Vandali, were a confederacy of German nations of the Suevic race, and originally dwelt on the northern coast of Germany. With the Sueves they entered Gaul in 406, gradually worked their way into Spain, which they entered in 409, and founded a kingdom there, from which comes the name Andalusia.

In 429 they crossed the Mediterranean and founded a state in the North of Africa, having Carthage as its centre. Under Genseric they subsequently, in 455, invaded Italy and plundered Rome.

Genseric was very cruel to his Catholic subjects, and was the first to instigate the persecution on a large scale of one body of Christians by another. The Vandals were finally overpowered in both Europe and Africa, and absorbed by the Byzantine Empire.

The Huns, or Hunni, were an Asiatic race dwelling on the plains of Tartary, and it was for protection from them that the great Chinese Wall was built. A portion of them migrated into Europe about 375, and settled in Thrace.

Under the leadership of Attila they overran the Western Empire, but yielding to the appeal of Pope Leo the Great, Attila left Rome undisturbed. A few years after his death, which occurred in 453, the kingdom of the Huns was destroyed by the Ostrogoths, and the remnants of the nation became incorporated with the other barbarians, and were not again a separate people in Europe.

MIDDLE AGES.

The history of the Middle Ages begins with a series of barbarian contests which attended and assisted in the downfall of the Western Roman Empire.

Before the end of the fifth century, Spain had been occupied by the Vandals, Sueves, and Visigoths; France by the Goths, Burgundians, and Salian Franks; Italy by the Huns, Vandals, and Ostrogoths; Russia and the great eastern plains by the Sclavonians; Germany remained in possession of the Teutons; and Denmark and the low countries near the North Sea were held by the Saxons, Angles, and Jutes. The Huns were finally forced back into Hungary, which their descendants and another Tartar tribe — the Magyars — still occupy; and the Vandals were driven across the Mediterranean into Africa. All the others mentioned were from the old Asiatic Aryan stock, and all of them, except the Angles and Saxons, had previously abandoned Paganism for the form of Christianity called Arianism, but they were nevertheless barbarians. The Franks were the first to adopt the Christian faith as promulgated by the Church of Rome, and it was among them that the leaven first began to work toward civilization.

In the sixth century the Eastern Roman or Byzantine Empire attained the height of its glory under Justinian, by whose direction the civil law, in the form of the Code, Institutes, and Pandects, was instituted. In this century also the Lombards, descending from the valley of the Po, took possession of Lombardy in Italy; and the Moslems, under the preaching of their prophet, Mahomet or Mohammed, began that system of religious conquest which made the Saracen Empire all-powerful in Asia Minor and Northern Africa, and subsequently threatened all Europe with Mahometan rule. Toward the close of the seventh century they made several unsuccessful attempts to enter Europe by way of Constantinople or Byzantium, but in 710 A. D. poured a host into Spain from Northern Africa, landing on the rock which, from their leader, Tarik-ben-Zaid, was called Yebel Tarik (Mountain of Tarik), — Gibraltar.

Their course of conquest was stopped in France by Charles Martel in the seven days' battle of Abderame, and they were forced to be content with Spain, which they held seven hundred years, to the very close of the Middle Ages. The Saracens played an important part in the intellectual history of this period, for they were engaged in the cultivation of science, art, and literature while the rest of Europe was in a state of comparative ignorance. This long time from the fifth to the eleventh century — sometimes called the Dark Ages — was the period required for the blending of race characteristics, which the physical features of the country and close intercourse of the conquered and conquering tribes rendered necessary, before any advance in civilization became possible.

This incorporation of Teutonic or Germanic barbarians with the Latin and Celtic elements into three separate nations having distinct languages (called Romance tongues), determined in character by the relative proportion of the Latin element, which is the distinguishing feature of each, and the development of national pride and spirit until it ended in the total subversion of the feudal system, constitute the history of the Middle Ages.

From the liberty-loving, independent spirit, and active, aggressive character of the Teuton, and the civilization of the effete empire, came strong, healthy, modern nationalities.

Germany, having no admixture of Latin or Celtic blood, remained distinctively Teutonic; but, on account of her surroundings, gained no more rapidly in civilization than her western neighbors. No advance was made by the nations east of Germany during this period, and the only national change was the possession of the Eastern Empire by the Turks.

England made no advance until the invasion of the Normans in the eleventh century, when the feudal system was established there as on the Continent, and she subsequently kept pace with France.

We come now to the consideration of the specific causes and distinguishing features of growth common to all these nationalities.

The foremost of these was FEUDALISM, a system resulting from the individual relations of men dependent upon their respective share in and contribution to the German conquests in Western Europe. Every freeman who helped in the conquests received an estate in land as his *allodium* (freehold), the size and importance of which corresponded to his influence and power as a warrior.

In course of time the custom obtained for the kings, chiefs, and larger freeholders to grant their followers and adherents portions of their own territory upon condition of faithful service in time of war.

Land thus granted was called a *feudum* or *fief*, and on account of the condition attached was said to be held by *feudal tenure.* The freeholder was the *lord suzerain*, or *liege*, and his fiefholder was a *vassal*, *retainer*, or *liegeman.*

Bishops and abbots obtained vassals by thus granting lands received from the kings.

Frequently, small freeholders, in order to secure the protection of a powerful lord, yielded their title to the lord, receiving the land again as a *fief.*

Nearly every fief had a castle, inhabited by the lord and his personal retainers and men-at-arms, and a *village*, in which dwelt freeborn men, called *villains*, or *serfs*, who passed with the soil from one proprietor to another. In this way the whole people, from king to serf, were bound together as by a chain. This chain, however, by the increasing power of individual chiefs, became broken into parts which, while connected with the king, were separate from each other; and, before the system became extinct, a few powerful barons were able to break from the service of, and even make war upon, the king.

It was this accumulation of power in the hands of a few great lords that caused in great measure the final overthrow of feudalism, and the centralization of absolute power in the king; and, strange as it may seem at first glance, it was to the *villains* that the kings looked for their support against the nobles.

The *villages* in time grew into large towns, and industries of many kinds made the citizens wealthy, and accumulated wealth required organization for its protection; hence the adoption of municipal regulations, with measures for defence against the robber barons, who seemed to consider these towns legitimate objects of prey.

The *municipalities* thus created became then, at the proper time, a source of power for the king, and also a means for the diffusion of general intelligence and the creation of commercial intercourse, always a source of civilization.

The church was another great element of strength for the kings in opposition to the feudal system, because it recognized in a centralized power the strongest ally in establishing its own adsolute spiritual dominion. To this end Hildebrand, one of the illustrious men of this age, known as Pope Gregory VII., contributed in the eleventh century, for he believed the church only could effect the civilization of Europe.

The most brilliant, as well as most useful, institution resulting from the feudal system was *chivalry.* Its chief corner-stone was *honor*, and from the exaggerated ideal of bravery and gallantry which it taught, came its nearest approach to an appreciation of the sentiments which distinguished civilization from barbarism.

It inculcated in the minds of the youth, who were to pass in gradation from *page* through *squire* to *knight*, the highest regard for, and most delicate attention to, the female sex. By such teaching knight-errantry became an exalted calling, and the title of *knight* was indicative of goodness, bravery, and a just and generous mind; yet, when Bayard, the last renowned knight worthy of the name, died in France in 1524, the great majority of men who wore the spurs were a disgrace to knighthood. But while chivalry as an *institution* perished, its essence yet remains.

Another contribution toward the destruction of the feudal system was the invention of gunpowder and its use in war, for it rendered useless the armor of the knight, and made his service no better than that of a footman; and in this blow to knight service it sapped the foundations of the whole system.

A series of events, impossible of occurrence but for chivalry, but which eventually aided in its overthrow, took place during the twelfth and thirteenth centuries, in the form of armed expeditions to Palestine, to deliver Jerusalem and the Holy Sepulchre from the infidel Turks and Saracens.

These expeditions were called *Crusades*, or *Wars of the Cross;* and they had for their origin the reputed injuries and indignities suffered, at the hands of the infidels, by European Christian pilgrims, while journeying to and from Jerusalem.

The enthusiasm necessary for the inauguration of the First Crusade was created by the preaching of Peter the Hermit, who detailed the sufferings of the Christians, and appealed to the chivalric sentiments of knighthood to open the way for safe pilgrimage. He was seconded by Pope Urban, who suggested that each Crusader wear upon breast or shoulder the symbol of salvation.

The marshalled army entered Asia with 600,000 men, of which 100,000 were mailed cavalry, the most renowned of the chivalry of Europe; but of this great host only about 1,500 cavalry and 20,000 foot soldiers survived the terrible march and reached the Holy City. All the others had succumbed to thirst, hunger, or fatigue, or to the sword of the barbarians. This surviving force took possession of Jerusalem, and elected Godfrey of Bouillon king of Palestine, July 23, 1099; thus ended the First Crusade. Christian rule continued in Palestine for eighty years.

The Second Crusade, preached by St. Bernard, was occasioned by the capture of Edessa, in 1145, and the slaughter of its inhabitants by the Turks. The result of this expedition was less favorable than the first, a mere handful of the armament reaching Jerusalem, and in too weak a condition to wage aggressive war.

The overthrow in A. D. 1189 of the Christian power in all Palestine, with the exception of the city of Tyre, by Saladin, Sultan of Egypt and Syria, was the cause of the Third Crusade. The great western emperors of Europe, Richard I. of England, Philip Augustus of France, and Frederick Barbarossa of Germany, took part in it. Emperor Frederick was drowned, while bathing in a small stream, soon after entering Asia, and but a small fraction of his army succeeded in joining the French and English forces at Acre, where they had gone by sea.

After the capture of Acre, the siege of which lasted twenty-three months, Philip, jealous of the glory of Richard, and disgusted by his arrogance, returned home.

Richard continued the struggle alone; and, though unable to accomplish the purpose of the Crusade, he obtained favorable terms for the Christian inhabitants of Palestine. There were five subsequent Crusades; but they were all diverted from their original purpose, and the Holy Land was finally left entirely in the power of the Mohammedans.

Although the Crusades were a failure as regards their original object, they aided indirectly in diminishing the power of feudal lords; for the latter returning impoverished, or failing to return, their estates became broken up into small freeholds by sale and transfer.

By the Crusades, also, different peoples were brought into close, friendly contact, causing an exchange of sentiments and ideas, and opening the way for commerce among themselves and with distant countries. Thus the spirit of fanaticism was mitigated, and the ideas of the survivors were liberalized and nationalized, and the way was opened for a great intellectual awakening in Europe.

The influences which we see were at work at the beginning of the fourteenth century continued to develop during this and the succeeding century, and hastened the march of civilization until the last vestige of feudalism, the distinguishing feature of the Middle Ages, had passed away. Science, art, and literature, through the liberalizing influence of established universities, were beginning to affect the popular mind; pride of race and desire for freedom from vassalage began to appear in the centralization of power in the crown; and prosperity among the people became manifest in connection with the development of commerce.

With this condition of affairs at the close of the fifteenth century, the foundations having all been laid for future development, the glorious dawn of the sixteenth century and modern society was ushered in.

ITALY.

The ancient history of Rome terminated, and that of the Middle Ages began, with the extinction of the Western Empire. The Goths, Lombards, Franks, and other migratory tribes had overrun and desolated the plains and cities of Italy.

Odoacer, who belonged to the tribe of the Heruli, was the first king of Italy, A. D. 476. He was succeeded by Theodoric, king of the Ostrogoths or Eastern Goths, A. D. 493. During the reign of Justinian, Emperor of the East, Italy became part of the Eastern Empire, and was ruled by Narses, the exarch or deputy of the emperor, A. D. 523.

The Lombards made themselves masters of Upper Italy, A. D. 569, and ruled the country till 774. It was during the reign of Astolph, one of the Lombard kings, that Pepin, king of the Franks, gave the Papal states to Pope Stephen, which gift began the temporal sovereignty of the Popes. The gift was confirmed by Charlemagne, son of Pepin, who defeated Desiderius, the last of the Lombard kings.

The successors of Charlemagne, called the Carlovingian kings, ruled till 888, when Charles the Fat, the last of them, died.

The feudal lords then elected the kings up to 947, when the German emperors became the rulers of the Italians, and governed the country till the time of William of Holland, A. D. 1250.

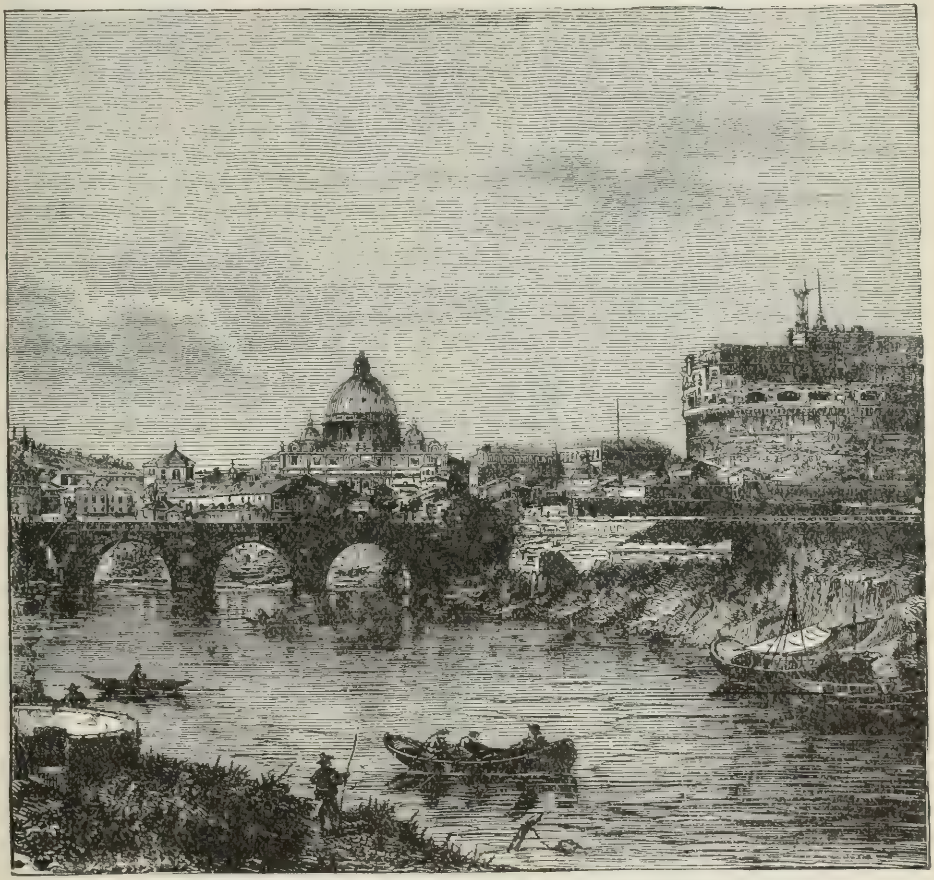
Rudolph of Hapsburg, the founder of the second house of Austria, through the instrumentality of Pope Gregory X., secured control of the northern part of Italy, A. D. 1273. It was about this period that Venice, Milan, Genoa, and Florence attained their greatest growth and historical importance, and the Two Sicilies, or Naples and the island of Sicily, were independent, flourishing, and prosperous.

Sardinia became a kingdom in 1720, and, in 1772, Savoy and Nice were annexed to France by force of arms.

Napoleon Bonaparte crossed the Alps and invaded Italy in 1796. He defeated the Sardinians and the Austrians, and made himself master of Lombardy. He also invaded the territory of the Pope, and compelled him to pay tribute. At the fall of Napoleon, in 1815, the Congress of Vienna cancelled the order of things instituted by him. Genoa was annexed to the kingdom of Sardinia, and Venice and Milan were given to Austria. The Pope also regained all the states of the Church, and Ferdinand IV. became king of the Two Sicilies

Secret societies, however, soon began to form in the country, and insurrections broke out in Naples and Piedmont in 1820. An Austrian army entered Italy and defeated the insurrectionists, after which order prevailed for a short time.

When the French Revolution broke out, in 1848, a national uprising took place in Italy, the object of which was to expel the Austrians. Venice succeeded in driving out the Austrian garrison, and the popular cause was espoused by Charles Albert, king of Sardinia. He invaded Lombardy, won a few small victories, but was finally defeated, and Milan and Venice were once more controlled by Austria.



ROME, SHOWING THE CASTLE OF ST. ANGELO AND ST PETER'S.

Meanwhile the subjects of his Holiness the Pope rebelled against his temporal sovereignty. Garibaldi entered Rome with an army of Italian volunteers and a republic was proclaimed. The Pope sought refuge in Gaeta, where the expelled king of Naples also resided.

Sardinia, at this time, took advantage of a revolution in Tuscany to drive the Austrians out of Italy. The Sardinians were defeated, and their king, Charles Albert, abdicated in favor of his son, Victor Emanuel II.

A French army under General Oudinot was sent to Rome for the purpose of restoring the Pope. They captured the city, July 2, 1849, and his Holiness returned in April, 1850, the permanent establishment of a French army securing his safety.

In 1853 the French Emperor promised to assist in driving the Austrians out of Venetia and Lombardy, and was to be recompensed by the cession of Savoy and Nice to France. War was declared and the Austrians were defeated at Magenta and Solferino by the French under Marshal MacMahon. In the peace which followed Lombardy was ceded to Sardinia, Venetia still remaining in possession of Austria.

In March, 1860, an insurrection broke out in Sicily, which was participated in by General Garibaldi, who defeated the royal army and proclaimed himself dictator. A popular vote was taken, which resulted in the annexation of Naples and Sicily to Sardinia.

When the war between Prussia and Austria occurred, in 1866, an alliance was formed between Sardinia and Prussia. Victor Emanuel attacked Austria on land with 80,000 men, and at sea with all his naval force. The Austrians defeated his army and his fleet, but they in turn were defeated by the Prussians at Sadowa. Peace was concluded at Nicholsburg, and Venetia was ceded to Italy.

The war between France and Germany, in 1870, necessitated the withdrawal of the French army from Rome; and the subsequent downfall of Napoleon and the establishment of the French Republic were taken advantage of by Victor Emanuel, who entered Rome, Sept. 20, 1870. The temporal power of the Pope was thus broken, and Rome became the capital of united Italy.

Victor Emanuel died Jan. 9, 1878, and was succeeded by his son, Humberto.

On the death of Pius IX., Leo XIII. became Pontiff. The unfriendly relations of the king and his Holiness are not changed, but time has somewhat softened animosities. Italy is now considered one of the great powers of Europe. She has a large military force, and her naval power is exceeded only by that of England and France.

SPAIN.

Spain was originally inhabited by the Celtiberians, who were an amalgamation of the Celts and Iberians. It was first colonized by the Phœnicians, and afterwards by the Greeks and Carthaginians. To the latter it was a source of great wealth. They were driven from the country, however, by the Romans under Scipio, 206 B. C.

The country was called Hispania by the Romans, and under Augustus and his successors it became one of the prominent seats of the civilization and learning of the empire.

In the fifth century Spain was overrun by the Suevi, the Alans, and the Vandals, all of whom were expelled by the Goths, who in turn were conquered by Theodoric, king of the Ostrogoths, in the sixth century.

In 711 the Mohammedans, under Tarik, crossed the Strait of Gibraltar, from Africa, and drove the Goths from Spain. Quite a number of their fortified places were taken by Louis, the son of Charlemagne, in 807, and formed into what is known as the "Spanish March."

The Christian kingdoms of Leon and Asturias were founded in the eighth century, from which period the Mohammedan or Moorish power became less, and independent states were gradually organized.

The kingdom of Castile was established in 982, and in 1037 it was united with Leon, the new state forming the strongest power in Spain. Aragon, which was a province of the kingdom of Navarre, became independent in 1035, and Portugal separated from Leon and Castile and became a distinct kingdom in 1139.

ISABELLA.

In the fifteenth century the Moors were finally driven from the country, and the marriage of Ferdinand of Aragon, and Isabella of Castile and Leon, united the whole country under one government, and thus formed the modern kingdom of Spain. It was during this reign that America was discovered, and Spain acquired large territories in the Western Hemisphere.

Isabella died in 1506, and Ferdinand ten years later. He was succeeded by his grandson, Charles I., better known as Charles V., Emperor of Germany, who added the Archduchy of Austria, the Netherlands, Mexico, and Peru to the possessions of Spain.

Charles left the imperial crown to his brother Ferdinand, and gave Spain, the Two Sicilies, and his Spanish dominions in America to his son, Philip II., who married Mary, queen of England. During his reign a rebellion broke out in the Netherlands, which resulted in the independence of the Seven United Provinces. He conquered Portugal in 1580, and obtained all the possessions of that country in Brazil, Africa, and the West Indies. The Invincible Armada, which he despatched for the invasion of England, is mentioned in the history of that country.

Philip died in 1598. His reign marked the beginning of the decline of the Spanish power, which his successors so rapidily hastened. Portugal re-established its independence in 1640, and Charles II. (the last prince of the Austrian line) was succeeded by Philip V., who established the Bourbon dynasty.

Nothing important marked the reign of his successors till Charles IV. was dethroned by Napoleon in 1808, and his brother, Joseph Bonaparte, placed on the Spanish throne. A war ensued, in which England became the ally of Spain, and which resulted in Ferdinand VII., the son of Charles IV., being placed on the throne.

From 1811 to 1821 all the Spanish colonies in America revolted from Spain and declared their independence. Afterwards civil war and political commotion harassed the kingdom, principally through the aspirations of the Carlists, a branch of the royal family. In 1868 a general revolution broke out, in which the royal troops were defeated, and the queen (Isabella II.) was obliged to take refuge in France. A provisional government was established, and the Bourbon dynasty declared at an end.

The crown was offered to Amadeus, son of Victor Emanuel, king of Sardinia, and was accepted by him. He was formally chosen and proclaimed king by the Cortes (Spanish Congress) in 1870. On account of a rebellion for the overthrow of his monarchy, Amadeus abdicated in 1873, and a republic was proclaimed, which in turn gave place to a monarchy under the present ruler, Alfonso, Prince of Asturias, and son of ex-Queen Isabella,

The area of Spain, including the Canary Islands, is about 195,774 square miles, and its population 16,835,506.

PORTUGAL.

This country forms a portion of what was anciently known as Lusitania. Its early history is merged in that of Spain, it having been successively in possession of the Romans, Suevi, Visigoths, and Moors.

As a reward for services rendered Alphonso, king of Castile, in his contests with the Moors in 1094, he gave to Henry, Duke of Burgundy, that portion of Portugal not held by them. Henry's son, Alphonso, who succeeded him, defeated the Moors at Orique, and assumed the title of king, A. D. 1139.

John I., who ascended the throne in 1385, made several successful expeditions against the Moors, and also obtained some brilliant victories over the Castilians. His reign is particularly noted for the practical aid and encouragement given by Prince Henry, the Mariner, to navigation and the progress of discovery, a species of enterprise and skill in which the Portuguese, for a long time, stood unrivalled.

During the reign of John II., Bartholomew Diaz discovered the Cape of Good Hope in 1486, and, in the succeeding reign of Emanuel, Vasco de Gama doubled the same cape and reached India. Previous to the discovery of the latter route, the European trade with India passed through the Red Sea and Egypt. The Portuguese enjoyed a monopoly for many years of the Cape route. The Dutch were the first to break the exclusiveness and availed themselves of the advantages offered by De Gama's discovery.

When the male line of the royal family of Portugal became extinct, in 1580, Philip II., of Spain, annexed the country to his dominions. The Spaniards held possession for sixty years, when they were expelled, and John, Duke of Braganza, the heir presumptive, was raised to the throne.

Shortly after the discovery of the Cape of Good Hope, the Portuguese discovered Brazil, which they colonized about the middle of the sixteenth century, and it formed, till lately, one of the most important Portuguese foreign possessions.

Portugal was invaded by the French in 1807, and the seat of government was removed from Lisbon to Brazil. The assistance of England was obtained, and the French were driven out of the country by Sir Arthur Wellesley, afterwards the Duke of Wellington. On the recall of the royal family, in 1820, King Joam left his son, Pedro, as regent of Brazil, and in 1825 it was acknowledged by Portugal as an independent empire.

On the death of Joam VI., in 1826, the Emperor of Brazil, who was his lawful successor, resigned his claim in favor of his daughter, Maria da Gloria. In the mean time Miguel, the brother of Dom Pedro, declared himself king, and a civil war ensued. Miguel was defeated, and Maria reigned till 1853, when she was succeeded by her son, Pedro V. This monarch did much to promote the prosperity of the country, but after a short reign of eight years he fell a victim to an epidemic in 1861. He was succeeded by his brother, Louis I., the present ruler, under whom the country has prospered.

Portugal covers an area of 34,500 square miles. The Azores and Madeira Islands comprise 1,237 square miles additional. The population, including the islands, is 4,677,562.

FRANCE.

During the fifth century, nearly all that extensive region included between the ocean, on the north and west, and the Rhine, the Alps, and the Pyrenees, on the east and south (called by the Romans *Gallia Transalpina*), fell under the power of a German tribe, known as Salian Franks. Their leader, King Clovis, or Clodwig, established his capital at Paris in A. D. 507, and, by his wisdom and his ability as a military leader, laid the foundation of the Frank, or French, nation. He seemed to intuitively know that religious sentiment is one of the strongest incentives to human action, and that what military prowess alone could never accomplish could be effected by union of church and state. Forming his resolution upon the battle-field, when the issue seemed doubtful, he religiously observed his vow to adopt the Christian faith; and the result was the firm establishment of the Merovingian dynasty, so called from *Merowig* or *Merovius*, the grandfather of Clovis. Its power was not lessened until after the death of the very able King Dagobert 1., in 638, who left his infant sons under the guardianship of two "mayors of the palace," Ega of Neustria, and Pepin of Austrasia, whose successors took advantage of the infancy and character of these kings in greatly increasing the power of the "mayors of the palace."

The mayors were originally only principal officers of the royal palace, and appointed by the king; later on they were nobles, chosen by their own order, to act as advisers of the king in peace and as generals in war, and finally the office became hereditary. After Dagobert's death, the mayors were the real rulers, though nominally the subjects of the *rois-fainéants* (sluggard kings), as the descendants of Dagobert were called. The most renowned of these mayors was Charles, surnamed Martel (the hammer), because, having defeated the Saracens in a decisive battle, at Abderame, between Tours and Poictiers, in October, 732, he was said to have hammered (*martelé*) them.

His son, Pepin, obtained from Pope Zacharias the title of king, and was consecrated in 752 by St. Boniface, Archbishop of Mentz, the apostle of Germany, thus beginning the Carlovingian dynasty, so called from his illustrious son and successor, Charlemagne (Charles the Great). He left to his sons, at his death, in 768, a great kingdom, of which Charlemagne, upon his brother's death, in 770, became absolute ruler. At the request of Pope Adrian I., he conquered the Lombards, and then took upon himself, in the name of religion, the task of bringing all barbarian Europe under Christian domination. This great undertaking he finally accomplished, and in 800 he was crowned at Rome, by Pope Leo III., as Emperor of the West. From this date to his death, in 814, he did all he could for the civilization and improvement of his subjects. His death was the signal for general revolt in the provinces which he had conquered, and in 843, by the treaty of Verdun, France was limited nearly as at the present day, and Germany and Italy became separate kingdoms.

Boulevard du Temple, Paris.

From this time the power of the Carlovingian dynasty declined, and in 987 it gave place to a feudal monarchy. Here the history of the French monarchy really begins.

Hugh Capet, Count of Francia and of Anjou, took possession of the throne in a manner similar to that employed by Pepin in the establishment of the Carlovingian dynasty.

The count proved himself an able ruler, and founded a dynasty which continued unbroken till the French Revolution, though he lived but nine years after his accession to the throne, dying at Paris, Oct. 24, 996.

His successors did little to increase their authority, exercising no personal influence and allowing affairs to drift on by force of the system of vassalage and military tenure previously established, until Louis VI., called *le Gros*, and subsequently *le Batailleur*, on his accession to the throne, in 1108, determined to remedy some of the evils which had been growing more and more unbearable during the reign of his father. After long and severe contests with those nobles who had made plunder their method of subsistence, he succeeded in putting an end to wholesale brigandage.

Louis VII., in the earlier part of his reign, considerably increased his power; but in the latter part he lost, on account of engaging in the disastrous Second Crusade, all he had previously gained.

His wife, Eleanor, by her divorce and marriage to the renowned Henry II. of England, took from Louis all the provinces he had acquired in marrying her, and left him a legacy of war with England for their possession, which finally ended only after centuries of contest.

His son, Philip II., surnamed Augustus, was the first of his line to possess and rule the present territory of France. He was truly a great king, devoting himself not only to the acquirement of possessions, but to the improvement of his people; encouraging industries, fostering institutions of learning, bestowing his treasures upon the poor, and increasing the sanitary and artistic excellence of his capital, — Paris. He died at Nantes, in 1223, possessing the esteem of all his contemporaries.

Louis IX., called St. Louis, one of the best kings that ever sat upon a throne, reigned from 1226 to 1270, having succeeded his father, Louis VIII., who reigned but three years. During his forty-four years' excellent rule, France increased in resources and advanced in the direction of true greatness and real prosperity to an extent hitherto unknown in Europe. From the death of St. Louis, in 1270, to the death of Charles VI., in 1422, the history of France is one of almost continuous war with England, ending in disaster and anarchy.

Seven years after, in 1429, when Charles VII. was in dire straits, and the English surrounded the city of Orleans, Jeanne d'Arc (Joan of Arc), a young, beautiful peasant girl, fired the religious sentiments and superstitious natures of the French soldiers and people, and at the same time filled the English soldiers with irrational dread, by the earnest declaration, and evidently honest belief, that she had received a revelation from heaven that she should lead the French army to victory, raise the siege of Orleans, and conduct Charles to Rheims for coronation.

Having persuaded the king that she had really been inspired for this work, he clothed her in armor and sent her to Blois to lead the army. Within a week the English had retreated from Orleans to the south of the Loire, thousands of soldiers had flocked to her standard, and all France was roused to enthusiasm. Troyes surrendered to her victorious arms within two days after she appeared before it, and she marched to and entered Rheims, which the enemy evacuated without a blow. Charles was then crowned, with the "Maid of Orleans," as she was called, at his side. She immediately earnestly requested permission to return home, considering her mission at an end; but

JOAN OF ARC.

finally yielded, against her wish and judgment, to the king's importunities for her to remain with the army.

She was wounded at the siege of Paris, taken prisoner while defending Compiégne, and delivered to the English by her captor, the Duke of Burgundy; was tried as a heretic by an ecclesiastical court, and, abandoned by her ungrateful king, was burned at the stake in the city of Rouen, May 30, 1431. Thus perished one of the most wonderful women of the world's history before she had reached her twenty-first birthday.

With her came the turning point in the fortunes of the French nation and the deathblow to feudalism. Charles subsequently became one of the most powerful monarchs of Europe, and died in July, 1461, leaving French territory freed from its enemies and a unified people subject only to the crown.

Louis XI., the successor of Charles, stamped out the remnants of feudalism and augmented the national strength. From his death to the crowning of Francis I., in 1515, the power of France continued to increase and tend further toward centralization. With Francis the monarchy became absolute. Upon his death, dissensions almost immediately arose among the courtiers of Henry II., and through the machinations of the Guises, Catherine de Medici, and others of their ilk, France had been brought, at the accession of Henry IV. (known as Henry of Navarre), in 1589, into a most wretched internal state, as well as externally a disgraceful one.

From this serious condition Henry elevated France to the highest degree of power it had ever attained, and taught the world a lesson concerning the recuperative power of that nation, which it has again learned since the Franco-German war of 1870. With Henry IV. began the Bourbon dynasty, the direct line of the Valois dynasty having become extinct at the death of Henry III.

Louis XIII. succeeded his father; but his mother, Marie de Medici, secured the regency during his minority. Under her government civil dissensions were constant; and when Louis, at thirteen years of age, assumed the control of affairs, he was ruler only in name.

It was at this time that Armand Duplessis de Richelieu, Bishop of Luçon, began to exercise his wonderful powers as a diplomatist in settling the quarrel between the king and his mother. He assumed a friendly attitude to the queen, but was really devoted to the cause of the king. His first services made him a cardinal, and the king's subsequent need made him prime minister. From this time he was the real ruler of France. He smote his enemies without mercy, but made his country great and prosperous. His death deprived France of the services of the most remarkable man of his time and of the greatest diplomat she ever had.

Six months later, May 14, 1643, Louis XIII. died, and his wife, Anne of Austria, was made regent during the minority of Louis XIV. Anne manifested excellent judgment in making Cardinal Mazarin her chief minister, for he was a man of genius and had been a faithful assistant of Richelieu. He continued the war policy of the latter, and at his death, in 1661, after severe struggles at home and abroad, left in the hands of his king a government undiminished in its power and freed from civil strife.

The government could not have fallen into better hands at this time. Louis XIV. had all the qualities of a great king, and but for the erroneous principles of action instilled into his youthful mind by the Italian cardinal, he would undoubtedly have made a better one.

He engaged in war with Spain in 1667, placed himself at the head of his army, and, with the assistance of the great generals, Condé and Turenne, soon had French Flanders and Franche-Comté at his feet. Europe became alarmed. England, Holland, and Sweden formed an alliance, and forced him to sign a treaty at Aix-la-Chapelle, by which he retained a part of French Flanders. The interference of Holland at this time was the real cause for his war with her, which commenced in 1672, and into which nearly all Europe was ultimately drawn against the aggressive Louis; but such was his power and the skill of his generals that he was enabled, at the treaty of Nimeguen, Aug. 10, 1678, to obtain the cession of Franche-Comté, a large number of places in the Low Countries, two imperial cities, and the province of Alsace. Spain could not endure her disgrace, and sought to regain what she had lost, but was still further humbled; and, at the close of his campaign in 1683, Louis was feared, as he was admired, throughout Europe. At this time his health failed, and to this cause is probably due much of the reverse of fortune which he sustained in the twelve years' war, which was terminated by the peace of Utrecht in 1713. It left the boundaries of France intact, and Louis's grandson, Philip V., on the Spanish throne, though it deprived him of most of his conquered provinces. Some of the most noted literary men of any age lived in France during this reign, and science and art flourished; but the true liberty of the people was not advanced.

At his death the regency of the Duke of Orleans succeeded during the minority of his great-grandson, Louis XV. The wretched financial condition of France during the regency continued under the rule of this licentious monarch, and France groaned under her burdens. Louis XVI. came to the throne in 1774. He married Marie Antoinette, daughter of Maria Theresa, Empress of Austria.

Louis really desired to benefit his people; but, beside youth and inexperience, he had difficulties to contend against which would have appalled older and wiser heads. His lack of determination and deficiency of judgment brought him under the influence of demagogues, and deprived him of the advice of the only men competent and worthy to direct in such a crisis, — M. Turgot, Lamoignon de Malesherbes, and the renowned Necker. Recklessness and extravagance were the order of the day, and the embers of discontent were smouldering, ready with the first favoring breeze to break forth into a popular conflagration.

At last the whirlwind came, and the most fearful anarchy that ever disgraced a people or devastated a country ensued. We cannot enter into the details of this terrible period, during which the king himself suffered death upon the scaffold. The people finally awoke to a sense of their terrible condition, the reign of terror ended, and order was restored. In August, 1795, the Convention decreed a new constitution, with the executive power vested in five persons, called the Directory.

The people of Paris were not pleased with the changes proposed by the Convention; and the Sections and the National Guards determined to force the Convention to perform their wishes; but Barras, the commander of the regular force, made Napoleon Bonaparte, a young Corsican officer, commander of the troops at the Tuileries; and Bonaparte settled the matter with grape-shot, Oct. 4, 1795, and put an end to the French Revolution.

From this time till the battle of Waterloo, June 18, 1815, the history of France and the history of Napoleon are almost identical. He was France, — her master, — and she greatly needed such a master at that time.

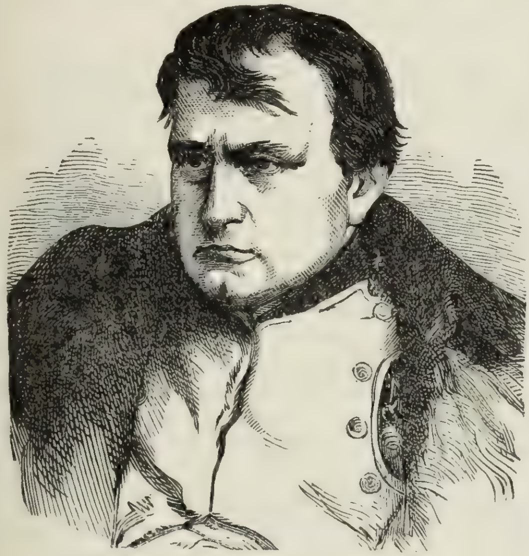
He, as consul and emperor, led the armies of France over all Europe, and for years held its destinies in his hands. Under his rule France reached the acme of her glory and prosperity. No monarch was ever more beloved by his people, or more feared by his enemies.

In his first campaign, with an army of one half the size of those he had to fight, he won battle after battle, and by force of his genius drove the Austrian armies out of Italy. In his second campaign, he forced the advantageous treaty of Campo Formio, whereby in October, 1797, France obtained possession of Milan, Mantua, Bologna, Modena, and the whole of the Austrian Netherlands.

In 1798–9 he conquered Egypt, took Gaza in Palestine, and defeated the Turks in a great battle at Mount Tabor, and in another at Aboukir, in Egypt. Finding that affairs were in a state of anarchy in France, he secretly sailed from Egypt, leaving Kléber in command of the army, and suddenly appeared before the Council of Five Hundred at St. Cloud, Nov. 10, 1799.

He scattered the Council with a company of soldiers and had a new constitution adopted, creating a consulate, with himself as First Consul. In the spring of 1800, having determined to crush the coalition against him, he led his army over the Alps and defeated the Austrians in the decisive battle of Marengo; and in February, 1801, Austria ceded Belgium and the left bank of the Rhine to France.

In August, 1802, the Senate proclaimed Napoleon First Consul for life; and in May, 1804, it gave him the title of Emperor. In May, 1805, he was crowned king of Italy, at Milan. Although the English under Lord Nelson destroyed his fleet, Napoleon carried all before him on the land. In 1809, after the Peace of Vienna, having divorced Josephine, he married Maria Louisa, Archduchess of Austria. In 1812 he began his disastrous campaign against Russia, and what all the armies of Europe had been unable to do was effected by the elements. By the burning of Moscow, and by starvation and cold, his magnificent army of 500,000 men was annihilated. He could not recover from this blow before the allies were upon him with overwhelming force. He was obliged to abdicate April 4, 1814. Louis XVIII., the brother of Louis XVI., was crowned. Ten months later Napoleon landed in France (having escaped from Elba), quickly assembled an army, and fought the battle of Waterloo, June 15, 1815. He died May 5, 1821, at St. Helena, where he had been imprisoned by England.



NAPOLEON I.

Thereafter, Europe rested easy. The reign of Louis was quiet, and terminated by his death in 1824, with France at peace. His brother, Charles X., succeeded him. In July, 1830, a revolution occurred, and in three days the people were masters of Paris. Charles fled, and died in Austria in 1836. His cousin, Louis Philippe, was elected king. In February, 1848, another revolution broke out, and Louis, under an assumed name, escaped to England, where he died two years later.

France, again a republic, with Paris in a state of anarchy, at length, on Dec. 10, 1848, elected Louis Napoleon, a nephew of Napoleon I., President of the Republic. In December, 1851, he was re-elected for ten years by a majority of seven million votes. He was proclaimed Emperor under the title of Napoleon III., Dec. 2, 1852, by a larger majority than he had received at his second election as President.

The general effect of his rule was material prosperity for France. His great mistake was in declaring war with Prussia in 1870, the result of which was his capture at Sedan, Sept. 1; his deposition as Emperor, Sept. 4; and the re-establishment of the French Republic, with M. Thiers as President, May, 1871. Napoleon went to England in March, 1871, and died at Chiselhurst, Jan. 9, 1873.

It seemed that France must be crushed under the enormous burden laid upon her by

Germany, which consisted of a war indemnity of one billion dollars ($1,000,000,000), to be paid in three years, and the loss of the province of Alsace, and one fifth of Lorraine.

To the astonishment of the world, however (such are the wonderful resources of the French nation), M. Thiers had provided for the payment of the whole indemnity one year and a half before the time stipulated in the treaty, thus securing the withdrawal of the German army from French territory.

Although several changes have since occurred in the ministry, France continues under a republican form of government, and is to-day one of the most prosperous nations of Europe.

GERMANY.

The German tribes first came from Asia, though when or how is not definitely known. They were permitted to enter the Roman dominions in Italy, 113 B. C. Notwithstanding this, they invaded Noricum, a Roman province, and by way of retaliation were treacherously attacked by the Roman army under Carbo. The Teutons fought bravely, and succeeded in destroying the entire Roman force sent against them. Seven years after they again defeated the Romans; but five years later Caius Marius attacked and routed them.

The word "German" means war-men. The Germans are described by the Romans as men of large stature, nearly six feet in height, with broad shoulders and great bodily strength. Their complexion was fair, eyes blue, and hair of a bright golden color. The children wore no clothing, and the men only a skin of some wild beast, bound at the waist by a belt. They appeared remarkably healthy and free from bodily infirmities.

Their chief defensive weapon was a long iron-pointed spear. They worshipped the sun, moon, and stars; their habits were rude, and they seemed to enjoy a wild life, not caring for the comforts of house or home. The women and children accompanied the men to battle, and the women preferred to die or kill themselves and children rather than fall into the hands of the enemy.

The Germans were democratic in their government; all questions of peace and war, and other matters of general interest, being decided in a popular assembly. The king of the tribe acted as chief magistrate in time of peace; while in war some tried warrior was leader.

Cæsar defeated the Germans, 58 B. C. and 48 B. C.; they were enrolled in the Roman army, and served under Cæsar in his wars. They were selected for the "Imperial Guard" because they were valorous, and, on account of their nationality, could be depended upon in civil commotions.

In the year A. D. 6, Quintilius Varus was Roman governor in the province inhabited by the Germans. He became rich, and the province poor; on which account dissatisfaction arose among the Germans, and the son of their chief, named Hermann, incited them to revolt. The Germans retreated before Varus into the Teutoburger Wald, a forest in the country now called Oldenburg, then surrounded and separated the Roman legions; their countrymen in the Roman army deserted, and the Romans, though fighting with their usual courage, were nearly all destroyed. Varus threw himself on the point of his sword, and most of his high officers did the same; the rest of the army, a small number, were taken prisoners, some of whom were sacrificed to the gods, and others became slaves, tending the swine or watching the sheep of the German peasants.

To this victory the Germans really owed their independence, for after sending two armies against the Germans, the first of which was defeated, and the last of which met with indifferent success, the Romans abandoned Germany forever, and the Rhine became the acknowledged boundary of the two nations.

From this time to that of Pepin, who increased his dominions, nothing of importance occurred. In 755 he gave the Pope, Stephen III., the land of the Lombards, and from that time commenced the temporal sovereignty of the Popes.

Charlemagne, or Charles the Great, succeeded his father Pepin. As a man and a monarch he has had no superior. "He stands alone," says Hallam, "like a beacon upon a waste, or a rock in the broad ocean." His temper was mild, he was just and liberal, was over seven feet high, and one of the most powerful men recorded in history. He was also a close student, and encouraged the arts, learning, and commerce.

During his reign of forty-six years, he organized fifty-six expeditions for the conquest of other countries. In the year 800 he received from Pope Leo II. the crown of the Holy Roman German Empire, and was at that time ruler of a vast territory, in fact, of all the European continent then known.

Charlemagne's descendants, the Karlings, made no great mark in history. The last one, surnamed Charles the Fat, was deposed, and the different nations then elected their own rulers.

Otto I., the Great, surnamed the Lion, increased the power of Germany. He defeated the Slavs, the Hungarians, and the Danes, and died in 973, at the age of sixty-one years, after a reign of thirty-eight years.

The part which the Germans took in the Crusades, and the names of their rulers, are mentioned in the history of those wars. Frederick I. (Barbarossa, or red beard), one of the greatest monarchs of Germany, appeared in the third of these wars. He held the reins of government with a master's hand, was a "terror to evil doers, and a protector to them who did well."

Another German ruler worth mentioning was Rudolph I. of Hapsburg, in Switzerland, who founded the dynasty which still rules Austria. He defeated the king of Bohemia, and took Austria from him, which was given to Rudolph's eldest son.

Albert I. of Austria, the son of Rudolph, oppressed Switzerland, among the people of which William Tell was the most prominent. The plague, called the "Black Death," which devastated Germany as well as the rest of Europe, Asia, and Africa, occurred in 1348.

Thirteen kings from the house of Austria ruled Germany from 1437 to 1740.

In 1516, Martin Luther began to preach his doctrines at Wittenberg, and a Diet met at Augsburg in 1518, at which Luther was condemned by the Pope.

In 1509 the Diet of Spires accorded liberty of conscience to the Lutherans only till the next general council, and issued a decree in which the ban of the empire was added to the excommunication of the Pope. The Lutherans protested against this decree as not being liberal enough, and thereby received the name of Protestants.

The Thirty-Years' War began in 1618, by a revolt in Bohemia. The Danes, Swedes, and French, on the part of Protestantism, also took part in this war against the Austrians and Spaniards, who represented the Catholics. The war ended in securing an equal establishment of the Protestant and Catholic religions. The object of the French was to curb the power of Austria, and that of the Swedes to extend their territory.

We now come to the important period of the reign of Francis II., Emperor of Austria and King of Germany. At that time (1792) the French Revolution began, and the two principal German rulers of Austria and Prussia formed an alliance against the revolutionists of France. The national assembly of France declared war against the allies.

It will not be worth while to follow the vicissitudes of the war before the advent of Napoleon. We refer to the history of France, where we mentioned Napoleon's campaigns, and will only state here that Germany was a member of six coalitions against France. In the second and third coalitions Austria was prominent, and in the fourth Prussia, while in the last all Germany was engaged.

Francis II. abdicated, in 1806, as German Emperor, and was known from that time as Francis I. of Austria. In the same year a confederation of German princes was formed, called the "Rhinebund." It was under the protection of Napoleon, but gradually dissolved as his power diminished.

The great battle of Leipsic, one of the most decisive of modern times, occurred in 1813. The French, under Napoleon, numbered 160,000 men, and the allied Austrian, Prussian, and Russian forces numbered 240,000 men. During the battle 12,000 Saxons in Napoleon's army deserted, which determined the result. Napoleon ordered a retreat over the bridge which crossed the river Elster. Under this bridge a mine had been laid, which exploded while a part of the French army was still on the Leipsic side of the river, into which many of the troops threw themselves, while others were killed by the explosion, and those unable to cross were taken prisoners.

The battle of Waterloo occurred June 18, 1815. The English, under Wellington, bravely stood their ground all day against the French, under Napoleon, who had commissioned Grouchy with 40,000 men to intercept Blucher with his Prussians, who were marching to join Wellington; but Grouchy failed to do so, or to arrive in time to participate in the battle. The Prussians reached the field at six o'clock in the afternoon. The French, disheartened by the appearance of fresh troops and overpowered by numbers, were completely defeated, and Napoleon was finally overthrown.

The German princes thought that all the lands taken from them by the French would be restored, but they were obliged to content themselves with the boundaries which existed in 1792. Napoleon's kingdom of Westphalia was abolished; Prussia received part of Saxony, the Rhine land, and Pomerania; Austria received back Tyrol and Salzburg; Hanover was made a kingdom; Weimar, Mecklenburg, and Oldenburg became grand duchies; and Lubec, Bremen, Hamburg, and Frankfort free cities.

The jealousies of the chief German rulers prevented the restoration of the German Empire, and the different states formed the German Confederation. The first session of the Diet was held Nov. 5, 1816. It had very little influence on the several German states, which were ruled by their sovereigns with a view to their own interests.

We pass over a period of forty years, Austria being the controlling military power until Prussia superseded her, and has since become more thoroughly German than Austria.

The Prussian minister, Count Bismarck, picked a quarrel with Austria. The Prussians were ripe for war; not so, however, the Austrians, who were completely vanquished. In June, 1866, war was declared by Austria, and in seven weeks it was ended with the Treaty of Prague, by which Austria was excluded from Germany. Prussia annexed Hanover, Hesse Cassel, Nassau, and Frankfort. The states of Southern Germany also agreed to place their armies at the disposal of Prussia in case of war, and the North German Confederation was established under the leadership of Prussia.

FRANCO-PRUSSIAN WAR. — In July, 1870, the Spanish government asked Leopold, Prince of Hohenzollern, to become their king. The French Emperor objected and Leopold declined, whereupon Napoleon demanded a promise of the king of Prussia (who is the head of the Hohenzollerns) that no prince of that family should ever sit on the Spanish throne. This demand was not acceded to, and on the 19th of July the French Emperor sent a declaration of war, left Paris with his son, crossed the frontier, and on the 2d of August took Saarbrück in Prussia. The Crown Prince of Prussia stormed Weissenbourg on the 4th of August; and on the 6th the French, under Marshal MacMahon, suffered a disastrous defeat at Worth; and, after another victory, the whole German army crossed over into France.

The French suffered disaster after disaster. Never were so many slain in a war which lasted so short a time, and seldom did victors take such spoil of arms and so many prisoners.

The fortified city of Metz, with a garrison of 180,000 men under Bazaine, was invested, Aug. 23, and a battle was fought at Sedan, in which Marshal MacMahon, who commanded the French forces, was wounded, the Emperor and his son being present on the field. The French finding that resistance was in vain, a flag of truce was hoisted on the fortress of Sedan, Sept. 1, 1870, and Napoleon placed his sword at the feet of William I., king of Prussia. He was sent to Wilhelmshöhe, where he was treated with the honor due his exalted rank. In March, 1871, he joined the Empress and his son at Chiselhurst, Kent, in England.

Many French towns were taken by the Germans, amongst them Strasbourg and Metz. On the 19th of September, 1870, Paris was surrounded, and after suffering greatly from want of food, it capitulated Jan. 28, 1871. Peace was formally signed at Frankfort on the 10th of the following May.

WILLIAM I., EMPEROR OF GERMANY.

The German princes assembled on the 18th of January, 1871, in the Palace of Versailles, and proclaimed William I., King of Prussia, Emperor of Germany.

In the treaty of peace France agreed to pay Germany the expenses of the campaign and an indemnity, both amounting to $1,000,000,000, and to give up Alsace and Lorraine, including the fortified towns of Strasbourg and Metz.

With the accession of this territory, the German Empire has now a population of 43,000,000. The Germans in Austria, Switzerland, and other states not belonging to the empire, amount to about 13,000,000.

The German Emperor represents the entire empire for all international purposes. The Reichstag, or legislative parliament, consists of one representative, chosen by ballot of the people, to every 100,000 inhabitants, and each state is represented in it accordingly.

The Bundesrath is a federal council consisting of members appointed by the governments of the respective states, the number from each being in proportion to its general and military importance. The Emperor must have the consent of this council before he can declare war, unless acting on the defensive.

The independent states (having absolute control of their internal affairs, and having regal or princely hereditary rulers, under constitutional limitations) which form this great empire are the kingdoms of Prussia, Bavaria, Würtemberg, and Saxony; the grand duchies of Baden, Mecklenburg-Schwerin, Hesse, Oldenburg, Saxe-Weimar, and Mecklenburg-Strelitz; the duchies of Brunswick, Saxe-Meiningen, Anhalt, Saxe-Coburg Gotha, and Saxe-Altenburg; and the principalities of Waldeck, Lippe, Schwarzburg-Rudolstadt, Schwarzburg-Sondershausen, Reuss-Schleis, Schaumberg, Lippe, and Reuss-Greiz. In addition to these hereditary governments, there are united to the empire the Reichsland of Alsace-Lorraine, and the three "free towns" of Hamburg, Lubeck, and Bremen. This general union is only for the purpose of unity of action of the German people in international matters, and does not affect the local interests of the states.

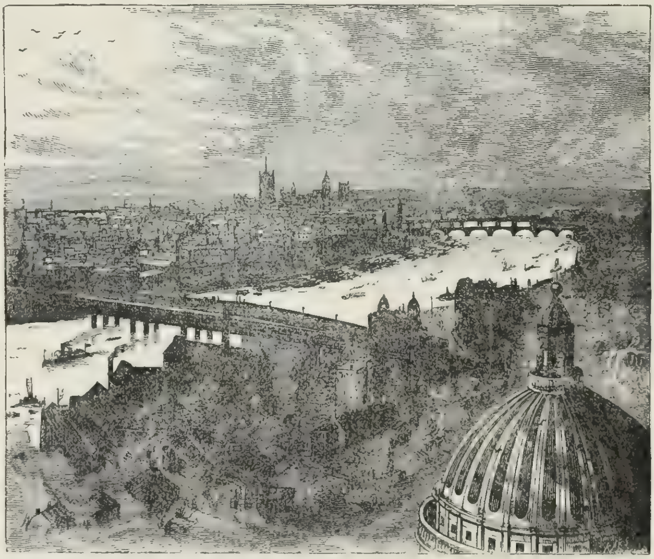
The "free towns" have resulted from the gradual increase in numbers and power of cities in certain small states; which cities, having adopted municipal regulations in accordance with their respective interests, ultimately assumed entire control of their own affairs, and established constitutional legislative governments, consisting of, in each case, a senate and house of burgesses. The senate is the chief executive body, consisting, in Hamburg and Bremen, of seventeen, and in Lubeck of fourteen persons, who are chosen for life by the House of Burgesses. The members of the Senate cannot hold public office. The Senate has power of veto of the legislative acts of the House of Burgesses, except in matters of taxation. In case of conflict, the matter is settled by arbitration, the arbitrators being chosen equally from Senate and House. The House of Burgesses consists, in Hamburg, of 160, in Lubeck of 120, and in Bremen of 150 members, who are chosen by the people in a manner to fairly represent the respective interests of all classes. A portion must have studied at the university, a portion must be householders, and others must be representatives of the respective guilds, corporations, trades, and industries. This body has the legislative power.

The High Court of Appeal for these "free cities" is composed of a president, nominated by the three senates, and six councillors three chosen by Hamburg, two by Bremen, and one by Lubeck.

ENGLAND.

England is the name which certain historical events caused to be applied to a part of the isle of Britain, and in order to make the working of those causes intelligible, it is necessary to take a summary view of its earlier history.

Though the Phœnicians traded with Cornwall, for tin, some centuries before the Christian era, yet little is historically known of Britain till the invasion of the country by Cæsar, 55 B. C. He found the Britons a rude and barbarous people of Celtic origin, and divided into numerous tribes. Their priests were called Druids, and exercised great authority over the people. The Roman Emperors, Claudius, Nero, and Agricola, continued the conquests commenced by Cæsar, and in the reign of the latter the entire southern part of the island was under Roman dominion.



London.

The remains of the three walls built across the island by Adrian, Antoninus, and Severus, the Roman commanders, to protect themselves from the warlike tribes of the north, are still to be seen. In the fifth century the Roman troops were finally withdrawn from Britain. Soon after their departure, the Picts and Scots, from that portion of the island now known as Scotland, invaded the country. The Saxons, a warlike people of Northern Germany, were appealed to for assistance against the invaders. After the defeat of the Picts and Scots, the Saxons, re-enforced by the Angles and Jutes (German tribes from between the Elbe and Weser), turned their arms against the Britons themselves, reduced them to submission, and compelled numbers of them to take refuge in what is now known as Wales. From the Angles the country was called Angle-land, or England. The amalgamation of the dialects of these different German tribes gave rise to the Anglo-Saxon language.

About one hundred and fifty years after the Saxon invasion, the Heptarchy, or seven kingdoms, was established, which, after an existence of about two centuries, became a monarchy, under Egbert, king of Wessex, or the West Saxons, A. D. 827.

Egbert and his successors were engaged in almost incessant wars with the Danes or Norsemen. Alfred the Great, his grandson, who came to the throne in 872, succeeded in driving them from the island; but during the reign of his successors the Danes succeeded in establishing themselves in the country, and Canute was proclaimed king of England in 1017.

The Saxon line was restored in 1041 in the person of Edward the Confessor. At his death in 1066, Harold, a descendant of the Danish kings, succeeded to the throne. His right was disputed by William, Duke of Normandy, who claimed the crown on the ground of its bequest to him, by Edward the Confessor. Harold was defeated and slain at the battle of Hastings, and William, surnamed the Conqueror, became king. This event is known as the Norman Conquest.

The language of the conquerors, which was of Latin origin, was used in all legal and ecclesiastical matters, while the Saxons held tenaciously to their native tongue. The fusion of the two languages in the fourteenth century gave us the type of English in which Chaucer sung. William introduced the feudal system, established the curfew, and compiled the *Domesday Book.*

The Norman kings were William I., William II. (surnamed Rufus), Henry I., and Stephen. The Plantagenets, who succeeded in 1154, were Henry II., Richard I., John, Henry III., Edward I., Edward II., Edward III., and Richard II.

Henry II., the first of the Plantagenet line, had by marriage and inheritance become master of nearly one half of France, and succeeded in annexing Ireland.

In the thirteenth century the English barons wrung from King John, in the meadow of Runnymede, the Magna Charta (the great charter), by which all the rights and good laws enjoyed by the people previous to his accession were confirmed. It has since been the bulwark of English liberty.

In the reign of Henry III., representatives were first sent from the boroughs to Parliament, and this event is viewed as the commencement of the English House of Commons.

Edward I. annexed Wales to England, and gave to his son Edward the title of Prince of Wales, a title which has since been borne by the eldest son of English monarchs. The wars with Scotland in this and the two succeeding reigns are referred to in the history of that country.

The period of the rule of the Plantagenets is regarded as the "age of chivalry" in England. It culminated in the reign of Edward III., whose son, the Black Prince, was its most conspicuous representative.

The last Plantagenet was deposed by Parliament in 1399, and the Duke of Lancaster, under the title of Henry IV., raised to the throne. The Lancastrian kings, who ruled from 1399 to 1461, were Henry IV., Henry V., and Henry VI. Henry V. invaded

France and won the celebrated battle of Agincourt, but in the reign of his successor the English lost most of their possessions in France, mainly through the efforts of the celebrated Joan of Arc.

The war between the houses of York and Lancaster (known as the Wars of the Roses) broke out in 1455. The symbol of York was a white rose, and that of Lancaster a red one. Both families were descended from Edward III., that of York from his third son, and that of Lancaster from his fourth; hence the contest for the throne. After a protracted struggle the house of York was successful, and Edward IV. proclaimed king in 1461.

The three kings of this line who ruled from 1461 to 1485 were Edward IV., Edward V., and Richard III. The intrigues and contests of the Lancastrians were kept up almost without cessation during this period, and in 1485, after the battle of Bosworth Field, they succeeded in having their representative, Edward Tudor, crowned as Henry VII.

The sovereigns of the house of Tudor were Henry VII., Henry VIII., Edward VI., Mary, and Elizabeth. The period of their rule extended from 1485 to 1603, during which time England was less disturbed by wars than under any other family of English kings.

Henry VII. left the throne to his son, Henry VIII., who married Catherine of Aragon, his brother's widow, and aunt of Charles V. of Spain. He wrote a book in reply to the attacks of Luther on the doctrines of the Catholic Church, for which the Pope gave him the title of "Defender of the Faith," a title which his successors have ever since retained.

The matrimonial adventures of this monarch, and the consequences resulting from them, form the most conspicuous transactions of his reign. He conceived a passion for Anne Boleyn, one of his queen's attendants, and requested the Pope to annul his marriage with Catherine. The Pope refused, and Henry, after having first been divorced by Cranmer, — one of his bishops, — married Anne and had her crowned queen.

In 1534, Henry was excommunicated, and in the same year Parliament declared the king the head of the Church of England. In less than three years after his new marriage, Anne Boleyn was condemned and beheaded, and on the following day the king married Jane Seymour, who died the succeeding year, when Henry married Anne of Cleves, from whom he got divorced. He next married Catherine Howard, who was soon beheaded; and for his sixth wife he took Catherine Parr, who survived him.

Henry levied onerous taxes, confiscated and destroyed property, and in other ways acted so that he is generally considered the most tyrannical ruler that ever sat on the English throne.

He died in 1547, and was succeeded by Edward VI., his son by Jane Seymour. This prince died in his sixteenth year, and was influenced to bequeath the crown to Lady Jane Grey, the great-granddaughter of Henry VII. She reigned but ten days, when she was beheaded, and Mary, daughter of Henry VIII. and Catherine of Aragon, ascended the throne. Mary married Philip II. of Spain, and after a short reign of five years was succeeded by Elizabeth, daughter of Henry VIII. and Anne Boleyn.

Elizabeth came to the throne in 1558, and during her long reign of forty-five years England attained a degree of prosperity it had never before known. The period was also made illustrious by those powerful lights of literature, — Bacon, Spenser, and Shakespeare.

The defeat of the Spanish "Invincible Armada," fitted out for the invasion of England, increased English prestige on the seas, and gave an immense impetus to English commerce.

The beheading of Mary Queen of Scots, grand-niece of Henry VIII., is by many considered a terrible blot on Elizabeth's character. Mary was tried, after an imprisonment of eighteen years, for being privy to a conspiracy for the alleged assassination of Elizabeth, with the object of having herself declared queen of England. Elizabeth is reputed to have recalled the order for the execution the day after it was issued. It was too late, however, and the unfortunate Queen of Scots perished on the block, 1587.

On the death of Elizabeth in 1603, James I. of England and VI. of Scotland, son of Mary Queen of Scots, ascended the throne. The reign of the Stuarts, as monarchs of England, covered the whole of the seventeenth century, except the interregnum between the reigns of Charles First and Second, and comprised the following: James I., Charles I. (the Commonwealth and Cromwell constituting the interregnum), Charles II., James II., William III. and Mary II., and Anne.

The accession of James I. to the English throne united the crowns of England and Scotland. He was a learned but pedantic monarch, and at his death in 1625 was succeeded by his son Charles I., who became involved in a war with Spain. Parliament having refused to vote him the supplies necessary to carry on the war, he proceeded to levy money in various ways. This was resisted by the parliamentarians and the people, and civil war ensued, which continued for several years, and which resulted in the execution of the king, and the establishment of the Commonwealth under Cromwell. Cromwell was the most prominent leader of the *Roundheads*, or supporters of the Parliament. The followers of the king were styled *Cavaliers*.

William Shakespeare.

Cromwell was proclaimed Protector in 1653, having governed from the death of Charles I. without that title. He suppressed a revolt in Ireland by very vigorous measures in 1649, and in Scotland in 1650, and dissolved the Long Parliament (which had been in session twelve years) in 1653. He defeated the Spaniards and the Dutch, and exercised a sway and influence in European countries unequalled by that of any individual till the rise of Napoleon Bonaparte.

Cromwell died in 1658, and was succeeded by his son, Richard Cromwell, who resigned the Protectorate after a few months; and the monarchy was restored, in 1660, in the person of Charles II., son of the last king.

The accession of Charles II. is termed the "Restoration." His administration was marked by prodigality and licentiousness, notwithstanding which the material prosperity of the country advanced considerably.

His brother, James II., who succeeded him, was an arbitrary monarch, and bent his energies to make Catholicism the national faith. His son-in-law, William, Prince of Orange, was invited to assume the government. When he landed at Torbay, the people flocked to his standard and James fled to France. His flight was declared, by Parliament, an abdication, and the crown was settled upon William III. and Mary, 1689.

The Revolution, as it was called, was more than a mere change of sovereigns. It finally transferred the ultimate decision in the state from the king to Parliament, by the passage of the Bill of Rights.

The stand made against William by the followers of James in Ireland, which ended with the capitulation of Limerick, in 1691, is referred to in the history of that country.

William was killed by a fall from his horse in 1702, and was succeeded by his sister-in-law, Anne, daughter of James II. In the first year of her reign a war was declared against France, in which Britain was allied with Germany and Holland. In this contest the allies had the advantage and gained the victories of Blenheim (1704), Ramilies (1706), and Malplaquet (1709).

In 1706, England and Scotland were united into one kingdom under the name of Great Britain. The treaty of Utrecht, which terminated the war with France, and gave Gibraltar in Spain, and the French North American possessions to England, was concluded in 1713.

The reign of Anne was marked by great attainments in philosophy and literature, and by some is styled the Augustan age of England. She died in 1714, and the Elector of Hanover was proclaimed king, as George I., the first of the house of Brunswick. The rebellion in Scotland, raised by the Pretender, son of James II., was speedily suppressed, and was the only event which ruffled an otherwise pacific reign. He was succeeded, in 1727, by his son, George II. His reign was marked by great military operations, in which Britain was generally successful, which include the war with Spain, that of the Austrian succession, and the American war with France.

The battle of Culloden (1746), which blasted the hopes of the Stuarts to regain the throne, was the last that was fought on the soil of Great Britain.

When George II. died, in 1760, England was the first maritime and colonial power in the world, and has since so remained. His son and successor, George III., had many private and public virtues, but his political errors and the mistaken policy of his ministers brought about a war with the English colonies in North America, which ended with the independence of the United States. The other most important events in this reign were the extension of the British dominions in India; the suppression of the Irish rebellion of 1798; the legislative union between Ireland and Great Britain, in 1800; and the overthrow of Napoleon, in which Great Britain played a prominent part.

For the last ten years of George's life, insanity rendered him unfit to rule, and the Prince of Wales acted as regent; and on the death of his father, in 1820, he ascended the throne as George IV.

During his reign the Corporation and Test Act was repealed, by which Catholics and Dissenters became eligible for corporate offices.

George IV. was succeeded by his brother, who ascended the throne as William IV. The most important event in his short reign of seven years was the abolition of negro slavery in the British dominions by the payment of $100,000,000 to the slave-holders as indemnity. He was succeeded, in 1837, by Victoria, daughter of his brother Edward, Duke of Kent. Three years after her accession, she married her cousin, Prince Albert of Coburg, and the following year Albert, Prince of Wales, was born.

QUEEN VICTORIA.

The reign of Victoria is checkered by many wars, those with China and those in support of the tottering Empire of Turkey being the most important.

The principal territorial acquisitions during this reign were the additions made to the British Indian possessions. The annexation of Sinde, the Punjab, and the kingdom of Oude were all the result of wars with the native princes. The Indian revolt and mutiny, which began in 1857, was characterized by the most horrible and relentless outrages on the part of both natives and British. It was suppressed, in 1859, and the government of India transferred from the East India Company to the British queen.

The repeal of the corn laws, in 1846, which abolished duties on the importation of grain, was due mainly to the untiring efforts of Richard Cobden and John Bright, two Liberal members of Parliament. The suppression of the Chartist movement, in 1848, an organization mainly composed of workingmen, who demanded radical and extensive reforms, crushed the only effort that bore the semblance of a revolution in England during the present century.

The introduction of the penny-postage system, in 1840, by Sir Rowland Hill, and the disestablishment of the Irish Church, in 1869, are among the most prominent legal enactments of this reign.

During the rebellion in the United States, the attitude of England, if not openly and avowedly hostile to the Union, was at least practically favorable to the Confederates; and England permitted privateers to be built and equipped in her ports for the purpose of destroying American commerce. After the restoration of the Union, a claim was made by this government on England for indemnity for losses sustained by the piracies of said privateers. The consideration of this claim was referred to an international tribunal, which met at Geneva, by the award of which England paid to the United States $15,000,000 as damages.

In 1876 an addition to the queen's title was made by act of Parliament, by which she was to be known as Queen of England and Empress of India.

The war with the Zulus in South Africa, in 1879, during which Eugène, son of the late French Emperor, was killed, resulted in the complete subjugation of that tribe, while that with the Boers, in the same section of that continent, was not so favorable to the English, and resulted in the practical independence of the Transvaal. Ostensibly to protect British interests, England interfered in Egypt and suppressed the rebellion of Arabi Pasha; and her troops still remain there, an obstacle to the control of Turkey.

England stands first among the nations of modern times in the greatness of her wealth, the extent of her commerce, and the vastness of her manufactures. She was the pioneer of modern civilization, and her people have shown an unexampled energy and capacity for colonization. It is estimated that the existing colonies and dependencies of Great Britain cover about one sixth of the land surface of the globe, and nearly the same proportion of its population.

While the means employed by England in the acquisition of territory frequently outraged the principles of justice and humanity, yet the immense fields she has opened to enterprise for settlement, and the impetus she has given to commerce with countries hitherto unknown or shut out from the world's trade, palliate to some extent her methods, and place the civilization of to-day under obligations to her.

While the colonies of the English-speaking race welcome industrious men of all nationalities, and of all classes and religions, they bear an unmistakable English stamp, and have been manifestly moulded by an English spirit.

CHRONOLOGY.

B. C.	
55	Cæsar invades Britain.
A. D.	
426	The Romans leave Britain.
455	Defeat of the Britons by the Saxons.
457	Establishment of the Heptarchy.
827	Egbert becomes 1st sole monarch of England.
857	First invasion of the Danes.
1005	Sweyn of Denmark proclaimed king of England.
A. D.	
1039	Canute II. — End of the Danish power.
1041	The Saxons restored, under Edward the Confessor.
1066	William the Conqueror — End of the Saxon and beginning of the Norman dynasty.
1154	Henry II., the first of the Plantagenets.
1399	Henry IV., first of the Lancastrian kings.
1461	Edward IV., first king of the house of York.

A. D.	
1485	Henry VII., first king of the house of Tudor.
1603	Stuart dynasty commences with James I.
1649	The Commonwealth begins with Cromwell as Protector.
1702	Accession of Anne, the last of the Stuart line of sovereigns.
1714	George I.—With him begins the Guelph line, or house of Brunswick.
1782	American independence recognized.
1815	Victory by Wellington, at Waterloo.
1837	Coronation of Victoria.
1853	The Crimean war begins.
1857	The Indian mutiny begins.
1859	Sir Colin Campbell and Gen. Havelock bring Indian revolt to an end
1860	Commercial treaty with France.
1861	Death of Prince Albert, Dec. 14.
1866	Wreck of the "London."
1868	Capture of Magdala, in Abyssinia, and death of King Theodore.
1869	Disestablishment of the Irish Church.
1872	Passage of the "Secret Ballot Act."
1873	Payment of the Alabama claims.
1878	The Afghanistan war.
1879	War with the Zulus
1882	War in Egypt.
1882	Bombardment of Alexandria, July 11.
1882	Arabi Pasha captured at Cairo, Sept. 15.
1885	Fall of Khartoum and death of Gen. Gordon, Jan. 26.

SCOTLAND.

This country occupies the northern part of the island of Britain, is one half the size of England, and is divided into Highlands in the north and northwest, and Lowlands in the south and west; it also includes the isles of Orkney, Shetland, and the Hebrides. The country was at first called Caledonia. Fergus, son of Erc, who emigrated from Ireland in A. D. 513, was the first prince of the British Scots; and Conal, great-grandson of Fergus, was king when Colum Cille converted the northern Picts in the sixth century.

Adrian, a nephew of Conal, gave the British great trouble by his invasions. In A. D. 836, Malcolm II. extended the territory of Scotland on the south by annexing Merse and Teviotdale, and thus the Tweed became the boundary.

Duncan succeeded Malcolm, and was succeeded by Macbeth, who was in turn succeeded by Duncan's son, Malcolm, A. D. 1057. Malcolm married Princess Margaret of England, and espoused her family's cause against William the Norman, but without success. In 1072 peace was restored, and English manners and customs were rapidly introduced, as well as numbers of the English people, and the English influence continued to increase during the reigns of Edgar, Alexander, and David. Malcolm IV. reigned for twelve years, and William the Lion, his brother, for forty-nine years.

In 1290, Baliol and Robert Bruce both claimed the crown, and submitted their dispute to Edward I. of England, who decided in favor of Baliol in 1292, because he agreed to hold it as subject to the English monarch. Baliol afterwards realized how foolish he had been, and tried to shake off England; but at Dunbar, Edward defeated and took him prisoner. Then William Wallace took up the Scottish cause, was successful for a while, and was made regent. Edward, at Falkirk, defeated Wallace, who was executed for treason in 1304. Robert Bruce, the grandson of Baliol's rival, then led the Scotch insurgents, and at the battle of Bannockburn, June 4, 1314, routed Edward and secured the independence of Scotland. The reigns of David II., Robert II. and III., were bloody epochs in Scotch history. James I., the poet king, succeeded in restoring order.

The succeeding Jameses and Mary all came to the throne under age. Mary was the unfortunate Mary Queen of Scots, who was so cruelly put to death by her cousin, Elizabeth of England, in 1587.

Religious strife broke out in the reign of James VI. and added to the general misery of the times. This monarch afterwards became James I. of England. Charles II. and James VII. governed Scotland so wretchedly that revolutions ensued, which resulted in placing

William and Mary on the throne. The Scotch had so intense a hatred for the English that, to prevent a civil war and disputes as to the right to reign, the English statesmen recommended a union of the two countries, and this was consummated in the reign of Queen Anne in 1703. The Scotch Parliament ratified this act in 1707, though bitterly opposed by the people.

Charles Stuart, commonly called the Pretender, and his adherent Highlanders were routed at Culloden in 1745, since which time the Scotch have grown more loyal to the English crown than the English themselves, and their history merges into that of England.

The population of Scotland is 3,734,370; and the area 25,000 square miles.

IRELAND.

The island which bears this name lies in the Atlantic Ocean, west of Great Britain, with which it forms the Kingdom of Great Britain and Ireland. It is separated from the other portion of the kingdom by the Northern Channel, the Irish Sea, and St. George's Channel. It is an irregular rhomboid in shape, the greatest width being 174 miles; the greatest length, diagonally, 302 miles; and the average width, 110 miles. The total area is 32,535 square miles. It has a coast line of 750 miles, with 90 harbors. The climate is mild and equable.

Trinity, Maynooth, and All Hallows Colleges are the principal seats of learning.

The original settlement of the island is ascribed by some to the Phœnicians; however doubfutl this may be, it seems settled beyond question that the Spaniards, under Milesius, established colonies there at an early period. Ireland is rich in antiquarian lore and relics. Its bee-hive houses and round towers, of which last there are one hundred and eighteen, have ever been a puzzle to archæologists, and in few countries can be found so many curious and interesting relics of the ages long gone by. The ancient name of the country was Erin, and her bards styled her "Sweet Innisfail." Cæsar, Tacitus, and Pliny called it Hibernia, while others called it Juverna. About 900 B. C., Olla Folla introduced triennial assemblages at Tara, and the records of the laws passed by them were called the "Psalter of Tara." This monarch founded schools of medicine, philosophy, history, astronomy, and poetry.

In 300 B. C., the country was divided into twenty-five administrative districts by Hugony, and his family right to the throne declared to be hereditary.

In A. D. 25, Feradach the Just erected Druidical altars and temples, and quelled an insurrection which had lasted twenty-five years. Conn Keadcahagh afterwards became the sole monarch.

In the reign of Cormac, the renowned Finn McCooil established his reputation as a great warrior. During this reign education and the arts and sciences received a fresh impetus, and military schools were established.

In 432, St. Patrick entered Ireland, as the successor of St. Palladius, on his mission to convert the people to Christianity. He attained his object, and died March 17, 493, at the age of one hundred and twenty years. The country now became renowned for the learning and piety of its children, and was styled by the writers of that day the "Insula Sanctorum," or Isle of Saints.

In the sixth century St. Colum Cille labored with great success to improve the religious condition of the inhabitants.

In 684, Egfried of Northumberland invaded and ravaged Ireland, and towards the close of the eighth century the country was overrun with Scandinavians, who captured five of the principal seaports.

In 840, Turgesius, the Dane, came with a fleet and destroyed churches and schools, and proscribed Christians; he inflicted seven years' misery on the country, and finally met his death at the hands of Malacchi, Prince of West Meath. King Nial III. roused the Irish, and drove the Danes from their strongholds, and Brian Boru, king of Munster, accomplished their final and complete overthrow at the battle of Clontarf, April 23 (Good Friday), 1014, and at the same time lost his own life. Malacchi then became king, and died in 1022, and his death is said to have been the beginning of the decline of the Irish monarchy.

During the twelfth century the country was a scene of almost ceaseless disorder and internecine strife.

Cardinal Papiron, a papal delegate, was sent to restore order and to correct existing abuses. Immediately on his arrival, in 1152, he convened the Synod of Kells, which acknowledged the supremacy of Rome, and created the Archbishoprics of Dublin and Tuam, making, with those of Armagh and Cashel (already in existence), four archdioceses. The Synod also adopted measures calculated to restore tranquillity.

About 1169, Dermot MacMorrough, who was driven from his throne for stealing another man's wife, appealed to Henry II. of England for aid to regain his possessions; and Henry, ambitious to add to his domains, acceded, and sent an army, under Strongbow, who captured a portion of the country, and did so well for himself and McMorrough, that Henry became jealous, and recalled Strongbow and all his subjects.

If the Irish had been united, Strongbow might not have obtained a foothold, and the country would probably never have been ruled by England; but dissension has, unhappily, ever been the primary cause of Ireland's misfortune.

The recall of Strongbow was a relief, and hence, when Henry landed, in 1171, he was welcomed by the people, and looked upon as a sort of a deliverer. To make his conquest easy, Henry produced a letter, twenty years old, said to be from Pope Adrian IV. (which was without much doubt a forgery), ceding Ireland to Henry. Ireland was virtually surrendered to him, and Roderick O'Connor, the last king of Ireland, afterwards paid tribute, and was nominally subject to England.

In the fourteenth century the English hold was lessened, the feudal system being in full force, and some of the princes and Anglo-Saxon barons having practically complete control in their own territory, some of them not even recognizing the authority of England; and the "pale," where the English held full possession, covered only a portion of Ireland.

The foreigners were becoming so intensely Irish, that the English government interfered, and it was ordered by Edward III., in 1341, that all offices be vacated, and that only Englishmen who had no personal interest whatever in the country should be appointed. This was followed in 1367 by the Kilkenny Statute, which made the intermarrying with the Irish, or adopting their customs, treasonable, and punishable with death. When Edward IV. came to the throne, he made it lawful to kill "any persons coming or going, having no faithful man of good name and fame in their company, in English apparel."

Elizabeth, on being crowned in 1558, immediately commenced the persecution of the people, and during her reign fierce and incessant wars raged throughout Ireland, especially during the last fifteen years, in which time she is said to have turned the country into a vast slaughter-house.

Hugh O'Neil, Earl of Tyrone, aided by Hugh O'Donnell, Prince of Tyrconnell, long and bravely battled for their country, defeating army after army sent against them. It was the noblest stand ever made for Ireland, but her foe was too powerful, and eventually O'Neil was obliged to accept terms of peace, which, however, were more liberal than the English laws had been.

Ireland has never resigned herself to the English yoke, and each rebellion has made the country more desolate, confiscation and eviction being the penalties enforced; and the land taken from the Irish leaders has been given to the English adherents. To make matters worse, the landlords have almost invariably resided abroad, thus tending to further impoverish the country.

A rising took place in Ulster in 1641, and extended to all parts of the country. Owen Roe O'Neil, the leader, defeated the English at Benburb, June 5, 1646, and was generally successful in overcoming them. After his death (from poison), anarchy reigned supreme, and reprisals were the order of the day till 1649, when Cromwell appeared on the scene, and with rapine, pillage, and plunder succeeded in establishing English rule throughout the country.

Under Sarsfield, Earl of Lucan, the Catholics, aided by some French, took up arms in behalf of the cowardly and exiled James II., of England, only to be defeated by William, Prince of Orange, at the Boyne, July 1, 1690, and at Aughrim, July 12, 1691. They surrendered on the 3d of October following, at Limerick, on terms which the English violated as soon as it served their purpose. Sarsfield and thousands of his companions entered the service of France, and yielded up their lives therein.

The Catholics were then persecuted with renewed bitterness, and continued to be for over a century, and they had absolutely no rights which any one need respect. It was death to teach, or harbor, or aid them in any way whatsoever. Henry Grattan, with fifty thousand armed volunteers enrolled, secured from the English the independence of the Irish Parliament (1782) and the repeal of some obnoxious statutes.

In 1791, Theobald Wolftone, whose life's aim was to destroy the Union, formed the United Irishmen's Society. The government, desiring to suppress it, proclaimed martial law, in 1798, throughout Ireland, and suspended the writ of habeas corpus, but the famous "rising" of '98 was not stifled till after the fight on Vinegar Hill in the same year.

The legislative union between Ireland and England was passed by a packed and bribed Parliament, in Dublin, Jan. 1, 1801. Shortly after this Robert Emmet started a revolt, which was without avail, and he forfeited his life in 1803. Daniel O'Connell, the great liberator, made his first prominent public appearance in 1813 as the champion of the people; and, by his untiring devotion, courage, and wonderful eloquence, he secured the emancipation of the Catholics, April 13, 1829.

Father Mathew, the "Apostle of Temperance," for several years labored publicly in its cause with signal success and with most beneficial effect, administering the pledge to over three hundred thousand people.

The people in the North of Ireland were better English subjects. The majority there were Protestant colonists or their descendants. The laws have been more favorable to them, and they have been and are in a much better condition than the rest of the inhabitants. England has ever discriminated against Irish manufactures, and in this respect the northern people have perhaps suffered most.

William Smith O'Brien tried hard to revolutionize the country in 1848, for which he and his confrères were transported. In this year a famine occurred, owing to the failure of the potato crop, by which nearly half a million people perished, though there was more food exported to England than would have supported the inhabitants of the country.

Some few years after this James Stephens started the Phœnix societies in Ireland, and his efforts were supplemented by Michael Doheny, who organized the Fenian Brotherhood in the United States in 1857. In 1869 the Episcopal, the established church of the country, was denied the right to collect taxes for its support, and in the following year the Irish Land Bill was passed. It is claimed that these beneficial measures were the direct result of the Fenian movement.

In April, 1879, the feeling of discontent resolved itself into a determination to try for better things by peaceful agitation. From the above time till August of the same year, a series of meetings were held throughout the country by the advice of Michael Davitt and others, and they culminated in the formation of the National Land League of Ireland, whose publicly avowed objects were,—

1. To abolish rack-renting, evictions, and oppressive taxation.

2 To enable the tillers of the soil to become the owners thereof on equitable terms

The accomplishment of these purposes was to be effected by influencing public opinion, by persistent demands for justice, and judicious resistance to oppression; one form being to pay no rent, where rent was considered exorbitant, until it was reduced to a fair valuation.

Charles Stewart Parnell was chosen president of the League, and right well has he established the wisdom of the choice.

Charles Stewart Parnell.

Parnell, Mitchell, O'Brien, Lord Edward Fitzgerald, Wolf Tone, the Emmets, Curran, Grattan, and perhaps the majority of the leaders of modern times, are or have been Protestants, who have risked everything and have labored, heart and soul, to ameliorate the condition of their people.

Parnell and several others were arrested by the Gladstone government and tried for conspiracy, but were acquitted by the jury. In order to compel the English Parliament to pay attention to the needs of their country, the Irish members availed themselves of all their parliamentary privileges to obstruct legislation, hoping thereby to gain some concessions from the enemy. They carried these measures to such extremes that they were turned out of the House or suspended for a short time on two different occasions, and finally a rule was adopted by which any member who incurred this penalty a certain number of times was liable to expulsion. The government also passed a law giving the Lord Lieutenant of Ireland the right to arrest and imprison during his pleasure, without trial or right of bail, any one who might be reasonably suspected of having been guilty of treasonable practices either before or after the passage of this act, no matter when the same might have been committed.

The practice of social and commercial ostracism, introduced by the Land League, is now universally known as "boycotting," and the name was derived from an agent named Boycott, whose unjust practices resulted in his servants and laborers leaving him, and the refusal of dealers to supply him with anything. No one would speak or sell to, work for, or buy from him for any consideration. Thus he was let severely alone; and his crops, which were worth $2,500, cost the English government $50,000 to harvest. The government, exasperated at the determination of the Irish leaders, arrested them, under the Suspect Act, and threw them into prison, where they remained for months. While the leaders were in prison the people resolved to pay no rent.

Among the arrested "suspects" were some citizens of the United States, and they were refused either a trial or release, which was contrary to all law or precedent. The understood policy of the United States has always been to protect its citizens wherever they may be, but the American minister at St. James evidently did not so consider it. Finding that the coercive policy did not prove as successful as was expected, Gladstone changed his course for a milder one, and released the principal suspects and most of the others. Forster was recalled from Ireland, and an era of good feeling seemed approaching, when Burke and Lord Cavendish were assassinated in Phœnix Park, which caused the government, for a short time, to adopt more rigorous measures; but eventually all the suspects were released and the Land League disbanded, the leaders forming a new organization.

The collections for the Land League, principally in America, have amounted to over $1,000,000. The agitation has been productive of great benefit. The condition of the people is much ameliorated, and the laws are, perhaps, more liberal than they ever have been heretofore under English rule.

The Land League having been condemned by the government, a meeting of Irish leaders was held in October, 1882, at which its principles were reiterated and the Land League was merged into the Irish National League.

TURKEY.

The Turks are first noticed in history about the year A. D. 800. They came originally from Asia, and are of Tartar origin. They captured a portion of Armenia, which they called Turcomania, and in a short time pushed their dominion to the Hellespont, and finally obtained a foothold in Europe.

The petty states into which their dominions were at first divided were united under Othman, one of their chiefs, in 1289, who established his empire at Prusa, in Bithynia. After him came his son, and then his grandson, Amurath, who established the Janizaries in 1362, a powerful and well-disciplined army, composed of youths selected from his Christian captives. He conquered the greater part of Thrace, and made Adrianople his capital.

His successor, Bajazet I., conquered the greater part of the Eastern or Greek Empire and besieged Constantinople; but being summoned to Asia to stop the encroachments of Tamerlane, he had to abandon the siege. Bajazet assumed the title of Sultan, his predecessors being known by that of Emir.

During the succeeding reigns of Mahomet I. and Amurath II. nothing of importance occurred till, in 1453, Mahomet II. took Constantinople and made it the capital of the Turkish or Ottoman Empire.

His grandson, Selim I., conquered Syria and Egypt, and Solyman the Magnificent annexed the greater part of Hungary and extended the Turkish dominions in the East.

From the reign of Solyman, the power of the Ottomans continued unabated till 1683, when John Sobieski, king of Poland, defeated the Turks, and drove them out of Austria and Hungary. Thenceforward the power of Turkey continued steadily to decline. By the peace of Carlowitz, in 1699, Austria, Venice, and Poland received back the territory previously wrested from them by Turkey.

During the eighteenth century Turkey was engaged in an almost uninterrupted series of wars with Russia, the result of which was seriously detrimental to the Turkish interests. Russia secured the Crimea and Azov, and the river Dniester was made the boundary between the two empires.

In the early part of the nineteenth century Servia and Montenegro revolted and secured for a time a state of semi-independence. The bulk of the population of European Turkey was at this time Christian; the Sclavonians, the Roumanians, the Albanians, and the Greeks being the principal races. The Greeks rose in rebellion in 1821, and adopted an independent provisional constitution in 1822. The manly efforts made by the Greeks in face of overwhelming odds induced liberty-loving people in many European countries to furnish the patriots with men and money. Prominent among those who figured in the struggle for Grecian freedom was Lord Byron, who died at Missolonghi in 1824.

Russia, France, and England finally interfered in behalf of the Greeks, destroyed the Mohammedan fleet at Navarino, and compelled Turkey to acknowledge the independence of Greece, 1829.

In 1853, the Emperor Nicholas of Russia demanded that a Russian protectorate be established over the Greek Christians in the Turkish Empire, — a demand that was resisted by the Sultan. Nicholas thereupon declared war and invaded the Danubian Principalities. England and France joined Turkey as allies in 1854, and in 1855 Sardinia also embraced the cause of the Sultan.

The Russians were defeated and had to evacuate the Danubian Principalities. The seat of war was then transferred to the Crimea, a peninsula in the South of Russia, on the Black Sea. Here the Russians were defeated by the Allies at the battle of Alma, Inkerman, and Balaklava. Sebastopol, the greatest Russian stronghold on the Black Sea, was besieged, and after a protracted resistance capitulated. Peace was finally concluded at Paris in 1856.

In 1875 an insurrection broke out in Herzegovina, one of the Christian provinces of Turkey. It continued for over a year, when Bulgaria, Servia, and Montenegro became involved. A treaty was made with Servia in 1877, by which the Servians were to retain their fortresses and territorial possessions, and the Turkish troops were to evacuate their positions on Servian territory.

The European powers having been unable to satisfactorily settle the differences between Turkey and her other rebellious provinces, Russia interfered in behalf of the latter, and declared war against Turkey in 1877.

A desperate struggle ensued, the most celebrated battle fought being that of Plevna, in which the Turks suffered a severe defeat. The result of the war was that the Danubian Principalities secured their independence, and Russia received Bessarabia, Batoum, Kars, and Ardahan in Asia.

Turkey in Europe at present covers about 62,028 square miles, and has a population of 4,275,000. Turkey in Asia occupies 710,320 square miles, and has a population of over 15,000,000.

In Egypt (the principal Turkish possession in Africa) the hold of the Sultan appears to be very weak. The present condition of Turkey seems to warrant the title, "the sick man of Europe," for some time applied to it. With other countries, especially Russia, apparently anxious to secure some of the Turkish domain, the Sultan seems disposed to concede disputed territory to little Greece, rather than risk further interference with its frail hold on its European possessions.

BELGIUM.

In the time of the Romans, Belgium was included in Gaul, and was known as Gallia Belgica. The people were mostly Celts, but while under the rule of the Franks, in the fifth and sixth centuries, by irruptions from the North the principal element of the population became German.

The country was afterwards divided into a number of independent duchies, counties, and free cities, the principal of which was the county of Flanders. The male line of the Counts of Flanders became extinct in 1385, and their possessions passed into the hands of the Dukes of Burgundy, who soon after obtained the whole of the Netherlands.

By the marriage of Mary of Burgundy with Maximilian in 1477, the Netherlands came into possession of Austria. Maximilian was succeeded by his son Philip, who married Joanna, daughter of Ferdinand and Isabella of Spain, in 1496.

Holland, the northern portion of the Netherlands, established its independence, while the southern portion, Belgium, continued under the rule of Spain. Philip ceded Belgium to his daughter Isabella and her husband the Archduke Albert in 1598, under whom it formed a distinct and independent kingdom. Albert died in 1621 without issue, and the country again fell into the hands of Spain.

Between 1659 and 1697, Belgium lost considerable territory in the wars between Spain and France and Holland. By the treaty of Utrecht in 1713, Belgium was assigned to Austria.

During the war of the Austrian succession almost the whole country fell into the hands of the French, but by the peace of Aix-la-Chapelle it was restored to Austria, 1748. In 1790 the provinces of Belgium revolted against Austrian rule, and formed themselves into an independent state under the name of United Belgium. They were however subdued by the Austrians in the end of the same year.

In the war with revolutionary France the battle of Fleurus (1794) put an end to the Austrian rule in Belgium.

In 1815 it was united with Holland under Prince William Frederick of Nassau. Belgium revolted in 1830, declared itself an independent state, and chose Leopold, Prince of Saxe-Coburg, as its king, in 1831. The five great powers afterwards determined the limits of the territory, making Holland and Belgium separate kingdoms. Leopold died in 1865, and was succeeded by his son Leopold II., the present monarch.

The government is a constitutional hereditary monarchy, the members of the House of Representatives being elected by citizens who pay not less than twenty florins annually in direct taxes.

The king can convoke, adjourn, or dissolve the Senate and House of Representatives at pleasure. Under the mild and successful government of Leopold, the country has prospered, and the people seem attached to their king and constitution.

HOLLAND.

The original inhabitants of Holland are supposed to have been of Celtic origin. In Cæsar's time, however, a large proportion of it was peopled by the German tribe of the Chatti. The Romans conquered the country early in the first century, after whom it was successively held by the Franks and the Saxons, till in A. D. 785, it was annexed to the dominions of Charlemagne.

After various changes in the ruling dynasties during the following centuries it was transferred by the marriage of Maximilian to the house of Austria, and resigned by the Emperor Charles V. in 1555, to his son Philip II. of Spain.

The seven provinces into which the country was divided revolted from the tyranny of Philip, and established their independence in 1606.

After their emancipation the commercial prosperity of the provinces steadily advanced throughout the seventeenth century. They took from the Spaniards some of their most valuable possessions in the East and West Indies, and established several important mining colonies which gave Holland vast temporary wealth.

The various naval contests with England in 1660 lowered the prestige of the Dutch on the sea, and made the English supreme on that element, while the efforts to conquer Holland made by Louis XIV. of France, almost annihilated the Dutch republic. After the peace of Utrecht, in 1713, the importance of Holland in European politics nearly came to an end. The French Convention declared war against her in 1792, and upon the flight of the Prince of Orange to England in the following year the Batavian republic was proclaimed. This was followed by a war with Great Britain by which Holland lost her colonies in both the Indies and in Southern Africa, which were taken from her by the English.

Holland was made a kingdom by Napoleon in 1806, who placed his brother Louis on the throne. At the return of peace in 1815, however, it was united with Belgium by the Congress of Vienna, and formed into a kingdom called the Netherlands, under the government of the Prince of Orange. The union was never cordial, owing to the difference in the religion, language, and customs of the people of both countries, and the connection was severed by the revolt of the Belgians and the establishment of an independent kingdom in 1831.

William I., king of Holland, abdicated the crown in 1840 in favor of his son William II. This monarch reigned but nine years, and at his death was succeeded by his son William III., the present sovereign.

Slavery was abolished in the Dutch colonies in 1862; and in 1873 the natives of Sumatra, under the control of the Dutch, revolted, but were subdued in the same year.

Holland covers an area of 12,680 square miles, and has a population of 3,809,527. It was originally a low swampy district, often swept by the high tides of the sea. By the patient labor of the inhabitants enormous dikes were built to prevent the inroads of the ocean. The land thus reclaimed was soon cultivated, manufactures and commercial ports were established, and to-day the country is peaceful and prosperous.

DENMARK.

The authentic history of Denmark commences in the early part of the tenth century, though it is known that the Danes in the eighth century were remarkable for their well-planned predatory expeditions by sea, as was proved by their repeated invasions of England, their occasional descents on Scotland, and their conquest of Normandy. Canute the Great became king of England, as well as of Denmark, in A. D. 1018, and in 1042 the Danish dynasty in England came to a close.

Of the sovereigns of Denmark in the Middle Ages, few were of distinguished ability. One of the most remarkable of them was Valdemar II. (1272), who conquered Holstein and Pomerania, and carried on a successful crusade against the Pagans in Esthonia. It was in this war that Denmark commenced to use the danneborg, or national standard, a white cross on a blood-red field.

The most important event in the history of Denmark in the Middle Ages was the union of Sweden, Denmark, and Norway under one sovereign by the treaty of Colmar (1397). This union continued till 1523, when, under the able leadership of Gustavus Vasa, Sweden asserted her independence.

The Danish government formed an alliance with Holland, and aided that republic in its sanguinary contest in 1652 with England, then under the authority of Cromwell. A protracted war with Sweden was waged in the middle of the seventeenth century, which resulted in several Danish islands being ceded to the Swedes; and in 1660 the monarchy, hitherto elective, was changed to an hereditary absolute government.

A second unsuccessful war with Sweden was terminated in 1720, from which time the cessation of the rivalry between the two countries was more perceptible in the decline of Sweden than in the progress of Denmark.

Copenhagen was attacked by the British fleet under Nelson in 1801, and in 1807 Napoleon threatened to make Denmark take part in the war against England. An English fleet and army were despatched to the Baltic, and the Danes had to surrender the whole of their naval force. By the treaty of peace which followed, Denmark ceded Norway to Sweden, and received Lauenburg and a money indemnity in exchange.

On the accession of Frederick VII. to the throne in 1848, the duchies of Schleswig and Holstein revolted, and after a bitter struggle of two years were subjugated. Frederick died in 1863 without male issue, and the ministry at Copenhagen proclaimed Prince Christian of Glucksburg king, as Christian IX., while the Duke of Augustenburg appeared in Schleswig, assuming the title of Frederick VIII. Germany espoused the cause of the latter, and in the war which followed the Danes were beaten, and were content to accept the terms of the peace of Vienna (1864), by which Christian IX. renounced all claims to Lauenburg, Holstein, and Schleswig.

Nothwithstanding her dismemberment, Denmark has prospered to an astonishing degree, and her material fortunes have been constantly in the ascendant. Since then her only trouble has arisen from the dissensions in the two houses of the assembly, and in the spread of dangerous communistic doctrines. The kingdom, as at present constituted, comprises the peninsula of Jutland on the European continent, and a group of islands in the Baltic. Its area amounts to 14,553 square miles, and its population to 1,902,000.

RUSSIA.

Rurik founded the monarchy in Russia in A. D. 862, previous to which all that is known of its history is that it was occupied by hordes of nomadic or wandering tribes, chiefly Tartars. Vladimir introduced Christianity, and founded several cities and schools, 980. For over two hundred years afterwards, the Tartars continued to invade the country, and eventually some settled in it.

The seat of government was established at Moscow in 1328. In 1481, Ivan I. expelled the Tartars, and took the title of Czar. Michael Romanoff, the founder of a new dynasty, from whom the present emperor is descended, was called to the throne in 1613. Under his son and successor, Alexis Michaelovitch, White Russia and Little Russia were wrested from the Poles in 1645, and the Cossacks of the Ukraine acknowledged the supremacy of the Czar.

In 1696, Peter the Great, son of Alexis, ascended the throne. In 1700, he joined a coalition against Charles II. of Sweden, by whom he was defeated at Narva; but Peter reorganized his army and defeated Charles at Poltowa in 1709. He built the first Russian fleet and conquered large provinces on the Baltic Sea. He also laid the foundations of St. Petersburg, and labored with success to improve and civilize his people. Though he met with great opposition, his decided character overcame all obstacles. From the time of Peter, Russia has gradually advanced in power and civilization.

Catherine II., who reigned from 1762 to 1796, displayed great talents for government. She increased her empire by the addition of a large part of Poland and an extensive territory on the Black Sea.

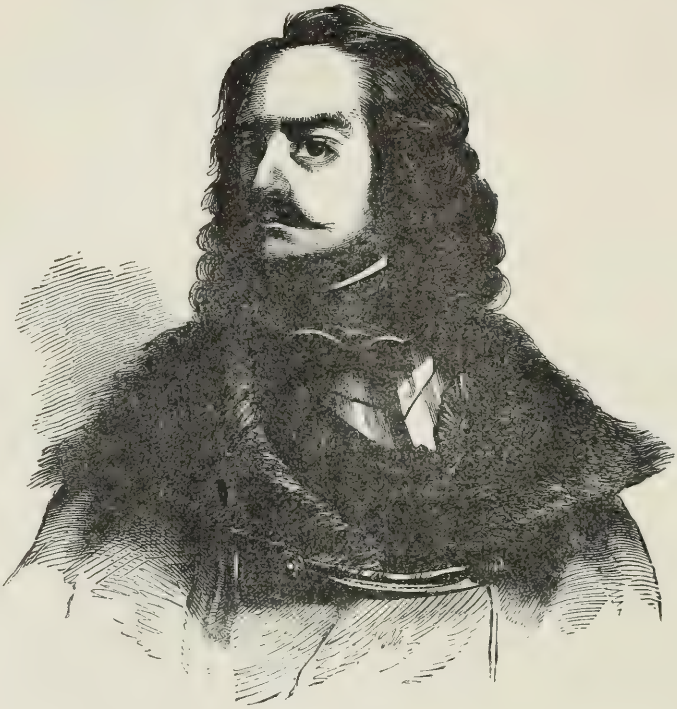
The attempt of Napoleon to conquer Russia in 1812 proved most disastrous to him, and materially aided his eventual downfall.

Nicholas, who ascended the throne in 1825, brought about a war with Turkey in 1854, in which France, England, and Sardinia afterwards took part on the Turkish side. It ended in 1856, by Russia agreeing that the Black Sea should be open to the commerce of the world, and that no war ships of any nation should enter it.

Nicholas died in 1855, and was succeeded by his son Alexander II., who set the serfs free. This class consisted of peasants who occupied small peices of land as tenants, and paid the landlord in labor, leaving about one day in the week to work for themselves.

Alexander was a stanch friend of the United States, and during our civil war he sent a fleet to make a demonstration in favor of the Federal government. His administration, considering the peculiar condition of his empire, was mild. A secret organization called the Nihilists has acquired an unaccountable power. Nothing is definitely known of them except their name, which implies the intention of the conspirators to render helpless the present government. The Czar Alexander fell a victim to them on the streets of St. Petersburg in 1881, and by his untimely death some contemplated reforms were abandoned.

The oppression of the Christians in Bulgaria (Russia's co-religionists), with probably a desire to increase its territory, brought Russia, in 1877, into a war with Turkey, which lasted fifteen months. After several bloody battles, Turkey secured an armistice, mainly through the fear of interference by other countries, especially England, which seemed imminent, and at a congress of the European powers a treaty was concluded at Berlin in 1878, by which terms were obtained for Turkey more favorable than was generally anticipated



PETER THE GREAT.

The present emperor, Alexander III., is the oldest son of the preceding monarch, and, owing to the fear of his assassination by the Nihilists, his coronation has not publicly taken place as yet, though it is believed that he was secretly crowned at Moscow, in September, 1882.

NORWAY AND SWEDEN.

The original inhabitants of Norway were Finns, who were dispossessed by the Northmen, a people of Gothic origin. Harold Harfager united and assumed sway over the whole country in the ninth century, and in the following century Olof I. established Christianity.

The reigns of his successors were marked by civil wars and anarchy, and in 1387 the kingdoms of Norway and Denmark were united. By the treaty of the union of Colmar, in 1397, Margaret of Denmark joined the three kingdoms of Denmark, Sweden, and Norway. From this period till 1814 the history of Norway is merged in that of Denmark. In the latter year the coalition against Napoleon transferred Norway to Sweden, which countries continue united under one sovereign.

Norway covers an area of 122,279 square miles, and has a population of nearly two millions.

In the beginning of the sixteenth century the Swedes were delivered from the tyranny of Christian II., king of Denmark, called the Nero of the North, by Gustavus Vasa, a descendant from the ancient kings. He was raised to the throne in 1523, and distinguished himself both as a warrior and a statesman.

Gustavus was succeeded by his son Eric, after whose death Johan, his brother, ascended the throne. Both of their reigns were uneventful. Sigismund, the grandson of Gustavus, who had been elected king of Poland in 1587, succeeded to the Swedish crown in 1592. He was deposed by the Swedes in 1599, and his uncle, Charles IX., was proclaimed king. After an uneventful reign of twelve years, his son Gustavus Adolphus succeeded to the throne. He took part with the Protestants in the Thirty Years' War and was aided by Richelieu, prime minister of France. He was very successful as a statesman and a sovereign; but was cut off in the midst of his triumphs at the battle of Lutzen in 1632. Christina, his daughter, who succeeded him, after reigning a few years, abdicated in favor of her cousin, who ascended the throne as Charles X. During his short reign of six years he engaged in wars with Poland, Russia, and Denmark, which were continued to some extent by his successor, Charles XI., till peace was obtained through the intervention of Louis XIV. in 1679.

After the accession of Charles XII., the three above-named powers formed an alliance against Sweden. Charles, after obtaining many victories over the Allies, was eventually defeated by Peter the Great at the battle of Poltowa in 1709. Since that time the Swedish territories have been subjected to a progressive reduction by the rising power of Russia. Charles, from his irrepressible ambition to augment his territory, has been styled by some the Alexander, and by others the Madman, of the North. He was succeeded by his sister, Ulrica Eleanora, who governed till 1751, when Adolphus Frederick ascended the throne.

Little of historical importance occurred during the reign of this monarch and his successor, Gustavus III. In 1808, Finland was conquered by Russia, and in the following year the king (Gustavus IV.) was deposed and his uncle ascended the throne under the title of Charles XIII. On the conclusion of peace with France in 1810 (against whom Sweden had joined a coalition), the Swedish Diet chose Bernadotte, one of Napoleon's marshals, as crown prince. In 1814, Norway was added to the Swedish dominion. When Charles XIII. died, in 1817, Bernadotte ascended the throne, assuming the title of Charles XIV. He was an able and prudent sovereign, and under him the country made rapid progress in the arts and manufactures. He died in 1844, and was succeeded by his son Oscar I.

The reign of this monarch was peaceful and uneventful. At his death, in 1859, he was succeeded by his son Charles XV. During his reign treaties of commerce were concluded with different European nations, free trade was established, and a new constitution was formed. Charles XV. died in 1872, and was succeeded by his brother Oscar II., the present sovereign.

Sweden covers an area of 171,750 square miles, and has a population of about 4,500,000. Its principal export is iron, which is considered the finest in the world.

AUSTRIA.

The kingdom of Austria is made up of portions of several different countries and provinces gradually annexed. The present dynasty derives its origin from Rudolph, Count of Hapsburg, in Switzerland. Having distinguished himself at home, he was raised, in 1273, to the imperial throne of Germany. The duchy of Austria was given to his eldest son, Albert, and still remains in the family. Rudolph was a wise ruler. His successors, however, did not inherit his talents, and they obtained territory and power generally by marriage.

Charles V. of Germany and I. of Spain, the most powerful monarch of the house of Austria, succeeded to the possessions of his brother Ferdinand, ruler of Spain. With the growing power of the Austrian princes grew also the opposition against them in Europe, and this was one of the main motives of the Thirty-Years' War, terminated by the treaty of Westphalia in 1648, which secured the independence of the different states of the German Empire.

In 1678, Hungary revolted and obtained assistance from the Turks, who in consequence acquired possession of the greater portion of Hungary; but in 1699 they were expelled, and the Austrians succeeded in obtaining an ascendancy over the Hungarians, which they have held ever since, though lately Hungary has been allowed more liberty than formerly.

By the death of the Emperor, Charles VI., the male line of the house of Hapsburg became extinct; but his daughter, Maria Theresa, who married Francis of Lorraine, succeeded to the imperial crown in 1748. Frederick the Great, king of Prussia, thereupon seized the greater part of Silesia. This was one of the causes of the seven-years' war which ended in 1763, when Silesia was ceded to Prussia.

Maria Theresa's successor, Joseph II., acquired Galicia from Poland and the Bukovina from Turkey. Joseph was a very able monarch, but was too radical in his reforms. He would have accomplished more had he attempted less. His death was lamented, and his memory is still held sacred by the Austrians and most of the Germans.

During the French Revolution and the reign of Napoleon, Austria sank almost to the rank of a second-rate power; but after the downfall of Napoleon she became as powerful as ever, and her loss of the Low Countries was compensated by her acquisitions in Italy and elsewhere.

In 1806, Francis II. gave up the title of Emperor of Germany and assumed that of Emperor of Austria. He was succeeded by his son Ferdinand I., during whose reign a revolution broke out in March, 1848, in consequence of which he abdicated in favor of his nephew, the present emperor, Francis Joseph I.

In a war with Italy (aided by France) he lost Lombardy and Venice, which were annexed to Italy.

The present emperor devotes himself entirely to internal improvements in his large empire, and his administration is perhaps the best Austria has ever had. Since 1868 his title is Emperor of Austria and King of Hungary.

PRUSSIA.

The rise of the Prussian power has been rapid and extraordinary. In the time of Charlemagne, Prussia was occupied by half-savage tribes, who were conquered in the fourteenth century by Teuton knights that reigned as feudal lords or petty princes, and resided in their castles, their dependants being subject to them as vassals. The country in the fifteenth century, under an Elector of Brandenburg, became tributary to Poland, and Frederick William, surnamed the Great Elector, was acknowledged sovereign of Prussia by the republic of Poland, A. D. 1657, when Prussia became a free and independent country.

When Frederick the Great ascended the throne in 1740, it had only 2,500.000 inhabitants. This able though despotic ruler (he was probably the last European monarch whose will was law) acquired Silesia against the efforts of Austria, Russia, and France. In the latter part of his reign he suggested the partition of Poland, and that unhappy country was shamelessly and dishonorably divided among Russia, Prussia, and Austria. When Frederick died he left his kingdom largely increased, and with a population of about 8,000,000.

His nephew, Frederick William III., who succeeded, proved himself unworthy of his lineage and station.

The contests of Frederick William III. with France in 1806–7 reduced the Prussian territory; but the spirit of the people helped greatly to overthrow Napoleon, and at the peace of 1815 Prussia recovered all her former possessions, a part of Saxony, and the Rhenish provinces.

Since her successful war with Austria in 1866, Prussia has been at the head of the German Confederation, and after the victories over France in 1871, her king was given the title of King of Prussia and Emperor of Germany. He is commander in chief of all the armies and navies of Germany both in peace and war (except the military powers of Bavaria and Wurtemberg in times of peace). He declares war with the consent of the Bundesrath, makes peace, and enters into treaties and alliances for the entire German Empire. He is ably assisted by the celebrated chancellor, Bismarck, and the great tactician, Gen. von Moltke.

Prince Bismarck.

Notwithstanding the progress made by Prussia under the reign of King William, a man named Hödel tried to assassinate him, May 11, 1878, and June 2 of the same year another attempt on the emperor's life was made by Dr. Nobeling.

The enormous indemnity obtained from France has been spent on a costly military system, which is acknowledged to be nearly perfect. The schools in Prussia are many and excellent. There were in 1881, 25,500 public schools, 1,500 private elementary schools, 500 middle-class private schools, and 280 grammar schools.

SWITZERLAND.

The ancient name of Switzerland was Helvetia. It formed part of the great German Empire up to the end of the thirteenth century, and was governed in some districts by lords and bishops, and in others by municipal corporations, as in other parts of the empire.

The cantons or districts of Uri, Schweitz, and Unterwalden enjoyed a sort of self-constituted government, under a peculiar imperial grant.

When Rudolph of Hapsburg was elected Emperor of Germany, he tried to convert the whole of Helvetia into a principality for one of his sons. The people, under the popular hero, William Tell, rose in insurrection in 1308; the three cantons formed a league, and called themselves Swiss, after the name of one of the cantons. Soon other cantons joined the Confederation, and the battles of Morgarten in 1315, and Sempach in 1386, satisfied Austria that further efforts against the Swiss were useless. The Emperor Maximilian formally recognized their independence as a nation in 1500.

Switzerland is a federative republic, consisting of twenty-two cantons, each of which has an internal government of its own.

The Federal Assembly, in which the sovereign power is vested, is chosen by universal suffrage, and the President of the Confederation is chosen yearly by the Assembly. A court of eleven members decides all civil cases between cantons, or between the cantons and the Confederation.

PLURIBUS UNUM.
UNITED
STATES
OF AMERICA.

CHAPTER I. — EXPLORATIONS.

ALTHOUGH we can trace the history of our country back only four hundred years with any certainty, still there is no doubt of the fact that this land was at one time inhabited by a very intelligent race, which practised, to some extent, the arts, as the relics of stone and copper tools, glazed pottery, and masonry, as well as the mines and curiously constructed mounds of the south and west, bear testimony.

Where these people came from, or how they were so completely blotted out, will probably remain a mystery until the end of time. It seems strange that the Aztecs had not the slightest knowledge or tradition of these people or their relics.

When the white man first came to these shores, he found them occupied by a hardy, active race of copper-colored savages; and as Columbus took it for granted that this was a portion of India, he called the natives Indians.

Their origin is wrapped in mystery, and no amount of theorizing seems likely to unravel it. The Indians believed in the immortality of the soul, the efficacy of atonement for sin, and in the existence of two great Spirits, — one of good, and the other of evil, — the former of which was all powerful. The several tribes differed widely in their social attributes and dialects, but their ceremonies were very much alike.

Some tribes cultivated the soil, while others preferred the chase. Each tribe had a sachem, chief, and medicine-man, or a counsellor, warrior, and doctor; these positions were held by the incumbents as long as they performed their several duties in accordance with the wishes of the tribe.

The Indians were divided into nations, and subdivided into tribes. The Esquimaux, or raw-meat eaters, occupied the extreme northern territory; next to them came the Algonquins, on the south and east, and the Dacotahs on the south and west. In the territory of the Algonquins were also found the Huron-Iroquois Confederacy, which (in 1539) embraced the Five Nations of New York and the Tuscaroras of the south.

The Five Nations are often referred to in history as "The Romans of the Western World," because they were supposed to present the best aspects of Indian character.

The Cherokees, a mild type of the savage, roamed through the wilds of Tennessee; farther south, the Mobiles were in control of forest and stream, while Texas furnished the wild Comanche with a hunting-ground as boundless as his spirits.

Then the brawny monarch of the forest was as impetuous and free of restraint as the mountain torrent; now he is peaceable and quiet, save when his stoic soul is stirred by fraud, abuse, or whiskey.

Having thus briefly sketched the aborigines of our land, let us take a hasty glance at its discoverers.

Among the many nations that claim to have visited these shores before Columbus, perhaps the Scandinavians are most entitled to credit; for it seems to be generally conceded by all the best writers on the subject, that Lief Erickson (or lucky son of Erick) visited the shores of New England, A. D. 1001. He was followed—so say the Icelandic traditions—by others of his countrymen; but their discoveries and explorations were of no material benefit to mankind at large, for no attempt was made to colonize the country. It is claimed, however, that the first child born of European parents on this continent was Snorri, son of Thorfin Karlsefni, a wealthy native of Iceland, who resided for three years in the part now called Massachusetts.

It is certain that previous to the time of Columbus the scholars of Europe knew nothing of the Western Hemisphere. Columbus believed that he could find a passage to the Indies by sailing westward. For eighteen years he sought from the courts of Europe the means to test the truth of his ideas. At last Isabella, the fair consort of Ferdinand of Castile, pawned her jewels, and at an expense of $20,000 fitted out a fleet of three vessels, which she placed at the disposal of Columbus. The expedition sailed from Palos on the 3d of August, 1492, and on the 12th of October, when seventy-one days out, Roderigo Triana, the lookout, proclaimed, "Land ahead." This land proved to be one of the Bahama Islands, and was taken possession of and named San Salvador by Columbus. The discovery of Cuba and Hayti followed soon after. Leaving a colony of thirty-eight men, Columbus returned to Spain in 1493.

In September of the same year he again set out for the New World, and visited Jamaica and Porto Rico; after nearly three years' stay he returned to Spain in 1496, with an abundance of treasure and some of the trophies of his exploits. The wonderful success of Columbus stimulated Vasco da Gama, of Portugal, and Cabot, a Venetian merchant of England, to engage in similar undertakings. Henry VII., then king of England, granted Cabot permission to make a voyage of discovery, provided he paid his own expenses,—which he did.

CHRISTOPHER COLUMBUS.

Cabot, accompanied by his son Sebastian, set out, and discovered Labrador and Newfoundland in 1497, and returned to England. Sebastian, who was then only twenty-one years of age, sailed for America in May of the following year, and explored the coast from Labrador to Cape Hatteras, whence he returned to England.

In the same year and month Columbus made his third voyage, and discovered the continent of South America and the Orinoco River.

It was during this year and month also that Vasco da Gama, the Portuguese explorer, rounded the Cape of Good Hope and reached Hindostan, thus solving the question as to the shortest route to India.

During the following year (1499) Amerigo Vespucci visited America and explored the northeast coast of South America, and on his return to Europe he published a full account of his voyage. This was the first public recital of the glories of the New World that Europe had received, for Spain had kept her good fortune to herself as much as was possible.

Vespucci was the first to claim the discovery of a new continent, and to deny that the new land was a part of India; but while he followed the course of Columbus, he carefully refrained from mentioning his name; and thus it was that the new land came to be known as America.

Columbus made his fourth and last voyage in 1502, discovering Darien and Honduras. He returned to Spain, broken in spirit by ingratitude, disaster, and misfortune, and died May 20, 1506, in Valladolid, at about the age of seventy years.

From this time forward hardy adventurers from all parts of Europe were seeking an opportunity to try their fortunes in the land beyond the seas.

Meanwhile the Spaniards were killing the natives and gathering their gold, and in search for the latter continued to push their explorations. Thus Ponce de Leon assumed control of Florida in 1512; Balboa took possession of the Pacific coast in 1513; and Cortes was engaged in subjugating the Montezumas.

In 1520, Ferdinand Magalhaens discovered the straits which bear his name. He was killed by the savages; but the crew continued the voyage, and completed the circumnavigation of the globe in three years and twenty-eight days.

France became interested in 1524, and sent Verrazani to explore the New World. He visited the coast of New England and called it New France.

In the following decade Pizarro invaded Peru, and treated the inhabitants with great cruelty.

In 1534, France again turned her attention to the western world, and this time Jacques Cartier had charge of the expedition. He sailed around Newfoundland and visited the Gulf of St. Lawrence.

Again, in 1535, Cartier sailed up the St. Lawrence, and named the hill on which Montreal now stands "Mont Real," or Royal Mount.

Six years after this De Soto discovered the Mississippi River, and was buried in its bosom.

The first permanent settlement in the United States was made in Florida in September, 1565, and named St. Augustine.

In 1572, Sir Francis Drake began his piratical career as an explorer, and returned to England in 1580, at the end of his second voyage, greatly enriched by his plunder. He had sailed around the continent, and as far north as Oregon in the Pacific, and reached England by a round trip.

Four years prior to Drake's return, Frobisher visited America, and discovered the straits which bear his name, and in a second voyage in the following year he found gold enough to defray all his expenses, but on his third trip he was less successful.

From 1580 to 1603 repeated attempts were made to colonize the English possessions in the New World by Gilbert, Raleigh, Grenville, White, and Gosnold, but their efforts were unsuccessful.

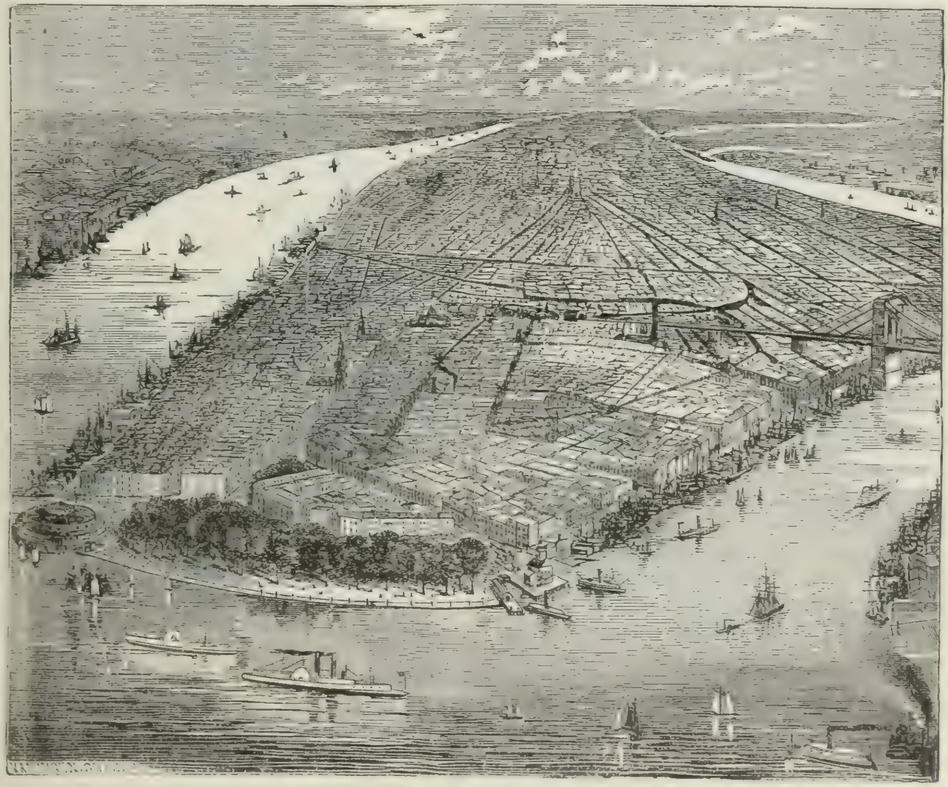
During one of these attempts Virginia Dare was born, and she is said to have been the first child born of English parents on this continent. About this time also potatoes and tobacco were introduced into England from America.

France sent out several shiploads of colonists in 1605, some of whom settled in Nova Scotia, then known as Acadia; others, under the lead of Samuel Champlain, the discoverer of the lake of that name, settled at Quebec; and thus began the French settlements in America, over whose destinies Champlain presided for sixteen years, until his death in 1635.

CHAPTER II.—PERMANENT COLONIZATIONS.

Religious intolerance had become so unbearable in England, that the desire to get to some place where greater freedom was possible led many to sigh for the "vast wilderness," and King James I. was induced to grant to a body of gentlemen, called the Plymouth Company, all of the New World between latitude 41° and 45°; and to another company, known as the London Company, the portion between latitude 34° and 38°.

The two companies sent out colonists at about the same time, the London party under Christopher Newport, landing at Jamestown in April, 1607; while the Plymouth party, under John Popham, landed in Maine, at the mouth of the Kennebec; but this colony soon broke up and returned to England. Meanwhile Jamestown grew in numbers and importance under the famous Capt. John Smith, whose life is said to have been spared by the Indians at the request of Pocahontas, the daughter of their chief.



New York.

In 1614 the Dutch settled New York and Albany. A number of families who had fled to Holland from England sailed from the former place to America in the now celebrated "Mayflower," and landed at Plymouth, Dec. 21, 1620. These people are known in history as "The Pilgrims." They at once formed a government, and chose John Carver as its head, and the redoubtable Miles Standish as military commandant.

John Endicott and his little band of Puritans landed in Salem, June 29, 1629; but they afterwards removed to Boston, in 1630. This was called the Massachusetts Bay Colony, to distinguish it from the one at Plymouth.

The Puritans made laws which had a tendency to abridge the freedom of those who differed with them in religion, and when Roger Williams denounced such actions, he was given the alternative of going back to England or leaving the colony. He took Gov. Wentworth's advice and went west with a few companions and settled in Providence in 1636.

While Williams was contending for toleration in Massachusetts, Lord Baltimore established a colony of Catholics in Maryland, and proclaimed freedom to all religions.

On the 19th of May, 1644, the colonies of New England and New York formed a defensive alliance.

The persecutions in New England on the charge of witchcraft began in 1644, and continued for some time afterwards.

In 1646, Massachusetts made education free and universal within her limits, and the support of schools compulsory. Harvard College was chartered in 1650.

Just as the colonies were growing prosperous, Parliament passed a law restricting their shipping to English bottoms; but William Berkeley, of Virginia, hired a Dutch ship and resisted the law so determinedly that the right was granted him to buy his ships where he pleased, and to trade with all nations; thus free trade was secured for Virginia.

Massachusetts banished the Baptists from her limits in 1663. In 1665 every town in the colony had a public school. A mail route was established, in 1672, between New York and Boston, *via* Hartford.

In 1676, Bacon's rebellion occurred in Virginia, but was soon crushed.

De La Salle, the Jesuit, made a careful exploration of the Great Lakes, and of the Mississippi and Ohio Rivers, and completed his labor in 1678 Four years later he took formal possession of the banks of the Mississippi, under the name of Louisiana

William Penn, of peaceful memory, arrived in America, Oct. 24, 1682, to look after the colonies he had planted there a year before. Philadelphia dates its beginning from a period immediately after Penn's arrival.

Seven years later, the people of Boston, disgusted with Gov. Andros's petty tyranny, seized and sent him back to England in chains.

At this time New England contained 150,000 people, and Massachusetts began the issue of paper money.

In 1692, Massachusetts Bay and Plymouth colonies united their fortunes, under the name of Massachusetts, which signifies "blue hills."

Virginia, during this year, founded William and Mary's College.

In 1695, South Carolina commenced the cultivation of rice, which had been brought from Africa.

In 1701, Yale College was established. "Queen Ann's War," or the war of the "Spanish Succession," occurred. The French and English colonies took part in the war, which was ended in 1713, by the treaty of Utrecht, by which England gained Labrador and Nova Scotia.

In 1701, lead mines were discovered in Iowa and Michigan, and Detroit was settled by the French.

In 1704, Rhode Island imposed a tonnage duty on foreign ships.

Indian massacres occurred in Massachusetts in 1704, and in North Carolina in 1712; and during the latter year the English brought numbers of negro slaves from Africa to the Carolinas.

In 1718, Massachusetts laid an import duty on goods of English manufacture, as well as upon English ships, and corn and tobacco were made legal tenders for debts in Maryland.

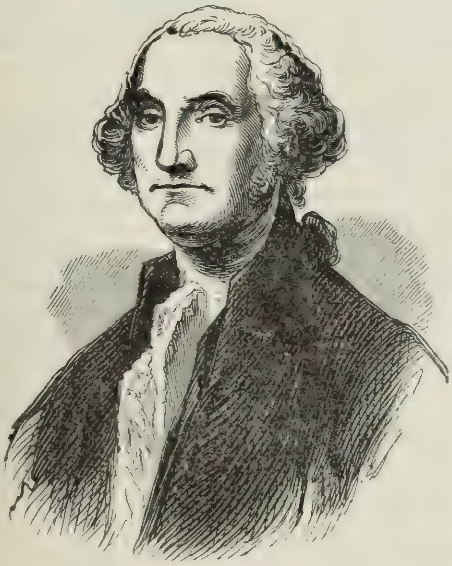
George Washington was born in Virginia, Feb. 22, 1732; and twenty-two years after the colonies became embroiled in the French war, which arose from the opposing claims of England and France to the territory of the New World.

The war was ended by the treaty of Paris in 1763, by which the French surrendered to England all their possessions in America.

The cultivation of sugar-cane was commenced in 1751, near New Orleans.

CHAPTER III. — REVOLUTIONARY WAR

In 1764 the British Parliament passed an act levying a tax on molasses, sugar, etc.; and severe laws were passed to secure the observance of this act. Many other acts were passed by Parliament destructive to the liberties of the colonies; and in 1765 the celebrated Stamp Act became a law, requiring all legal documents, pamphlets, and newspapers to be on stamped paper furnished by the government at exorbitant prices. This aroused the ire of the people, and their protests were numerous and determined. The act was repealed in 1766, only to be followed, in 1767, by an act taxing tea, glass, paper, and paints. The colonists agreed not to buy or sell English goods.



G:o Washington

M Washington

A regiment of English troops was sent to Boston, which only added fuel to the flame, and brought about a riot, in 1770, between the soldiers and the people. Trouble, also, ensued in North Carolina in 1771, and in Rhode Island in 1772, where the people seized and burnt the British armed schooner "Gaspée."

On Dec. 16, 1773, at Boston, a vessel laden with tea, which the people would not allow to be landed, was seized by them and its cargo thrown overboard. It was a tea party *par excellence.*

The next year Parliament forbade the landing or shipping of merchandise from the wharves of Boston. This was followed, in September, by the Colonial Congress, held in Philadelphia, recommending the entire suspension of commercial intercourse with Great Britain. Thereupon Gen. Gage, who was governor of Massachusetts, was ordered to subdue the colonists, and 10,000 troops were sent to help him. Gage usurped all authority.

The representatives of Massachusetts formed a provincial congress and proceeded to "boycott" the English officials and their friends. A call was issued also by Massachusetts for 12,000 men, ready for battle.

On April 19, 1775, while on their way from Boston to Concord to destroy some military stores of the colonists, the British troops were met by a company of farmers, whom they dispersed with little trouble; but on their return march, after the destruction of the stores, the Regulars were severely handled by the colonists, who attacked them from all sides and inflicted on them a heavy punishment.

This event was followed by the capture of Ticonderoga and Crown Point by the Americans, under Ethan Allen, and the appointment of George Washington as commander in chief of the American forces.

Two days after this last event, on the 17th of June, 1775, the battle of Bunker Hill was fought, at which the English secured a dubious victory at a heavy sacrifice.

On the 3d of July following, Washington arrived in Cambridge and took command of the Continental army, which then consisted of 14,000 raw recruits, with the rudest implements of warfare.

Gen. Montgomery led an expedition against the Canadas and captured Fort St. John and Montreal, together with eleven vessels laden with war stores; but Montgomery lost his life on the 31st of December, 1775, in a vain assault upon Quebec. Benedict Arnold distinguished himself in this campaign, which, singular to relate, also numbered among its participators the other traitor, Aaron Burr. The Americans were driven out of Canada as soon as the spring opened.

Dunmore, royalist governor of Virginia, burnt Norfolk, on New-Year's day, 1776, to punish the rebels.

Gen. Howe replaced Gen. Gage, as commander of the British forces in Boston.

Washington fortified Dorchester Heights and compelled Lord Howe to evacuate Boston on the 17th of March, 1776.

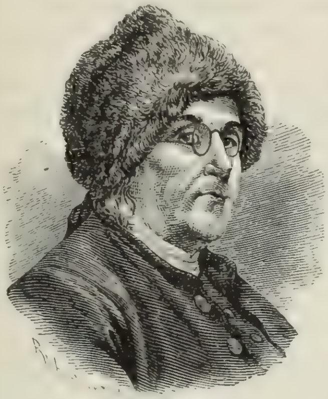
On the 28th of June the British began the bombardment of Charleston, S. C., but the Americans, under Col. Moultrie, repulsed them.

On the 4th of July, 1776, Congress, by a unanimous vote, adopted the Declaration of American Independence, which Declaration was received with joyous outbursts throughout the land. The States selected their own governors, and social distinctions were abolished.

The Americans, under Gens. Sullivan and Stirling, suffered a defeat at Long Island, N. Y., at the hands of Gens. Clinton and Cornwallis, Aug. 27; but Washington succeeded in saving the army from a total rout by a masterly retreat.

Lord Howe asked for a conference, and John Adams, Franklin, and Routledge were sent to confer with him, and he offered a full pardon to the rebels if they would return to their allegiance to England; but he was informed that the time for that business had passed, and so the conference ended.

On the 16th of September the English took possession of New York.



BENJAMIN FRANKLIN.

During the fall and winter of 1776, the Continental army suffered a series of reverses and hardships, and Washington had all that he could do to keep his army of 3,000 men from utter destruction. On the 8th of December he crossed the Delaware, and the British attempted to follow, but could get no boats, so they waited for the river to freeze. Fearing an attack on Philadelphia, Congress adjourned to Baltimore.

So many victories led the English to believe that the war was at an end, and Cornwallis turned over his army to a subordinate and left New Jersey. Washington thereupon crossed the Delaware again, attacked Trenton on the 25th of December, and captured the Hessians.

Cornwallis returned in a hurry, and the battle of Princeton followed, Jan. 3, 1777, in which the British were again defeated; and in six months' time they were driven out of New Jersey.

On the 22d of May, 1776, Col. Meigs attacked the British and destroyed their stores at Sag Harbor; and Gen. Prescott, of the British army, was captured by Col. Barton, at Newport, July 10. Congress then returned to Philadelphia.

Marquis De La Fayette arrived in America in April, and entered the American army.

During 1777 the French supplied America with more than 20,000 muskets and 1,000 barrels of powder.

Gen. Burgoyne swept down from Quebec, through New York, and captured Crown Point, Ticonderoga, but was checked at Hubbardston long enough to allow the Americans to get out of their way; afterward Burgoyne captured the stores of the Continental army at Whitehall.

Then followed the British defeat at Fort Schuyler, Aug. 3, which was considered a very important post. A similar disaster happened to them, Aug. 15, at Bennington, where John Stark and his neighbors put the English troops to flight. But the American forts, Clinton and Montgomery, on the Hudson, were taken by the invaders.

GENERAL LA FAYETTE.

On the 7th of October, Gen. Gates defeated Burgoyne, who retreated to Saratoga, where he surrendered to the Americans on the 17th of the same month.

Next came the defeat of the Americans at Brandywine, Sept. 11, and the occupation of Philadelphia by the British, Sept. 26. The English then had matters almost their own way.

Washington went into camp at Valley Forge, and the army endured untold sufferings. Confidence in Washington was shaken, and the cause of the colonies looked dark, but late in 1777, Baron Von Steuben arrived, with $200,000 worth of military stores for Washington, and from that day the prospects grew brighter.

Among the noble foreigners who rendered distinguished service during the Revolution may be mentioned Gens. Pulaski, Kosciusko, and Baron De Kalb. Lee and Franklin, who had been sent to France in 1776, succeeded in negotiating a treaty of alliance with that country, which went into effect Feb. 6, 1778, when France acknowledged the independence of the United States.

On the 18th of June the British evacuated Philadelphia and retreated across New Jersey, followed by Washington. On the 28th the battle of Monmouth was fought, with the advantage on the side of the Americans.

New York now became the seat of war. On the 11th of July, Count D'Estaing's French fleet arrived at Sandy Hook to co-operate with the Americans, but was of little service.

Just prior to the arrival of the French fleet, the people of Wyoming, Pa., were butchered, and their homes burned by the Tories and Indians.

On the 29th of December, 1778, the British defeated the Americans at Savannah, who then retreated to Charleston. Thus, after nearly four years' war, the English held New York City, Newport, R. I., and Savannah, Ga., and the Americans held the rest.

In 1779 the English gained both Verplanck's and Stony Points, and destroyed Norfolk and Portsmouth, Va., and East Haven, Norwalk, and Fairfield, Conn. But "Mad Anthony" Wayne retook Stony Point and destroyed it, Aug. 15.

In this month also, the Indians and Tories were made to suffer for their acts at Wyoming. Over forty Indian villages were destroyed by the avengers. Meanwhile the war was raging in Georgia, where the contending armies were dodging and fighting with varying success, until the British defeated the allied forces at Savannah, under Gen. Lincoln and D'Estaing, who had returned to the fight.

PULASKI.

BARON DE KALB.

KOSCIUSKO.

Paul Jones, after a most desperate fight, captured the British frigate "Serapis" and a merchantman, off the coast of Scotland, Sept. 23.

The Continentals were reduced to a pitiable condition; their treasury was bankrupt, and their soldiers were starving. But 1780 still found them fighting in New Jersey and the South. Charleston succumbed to the English on the 12th of May, and by a series of small but bloody victories the British gained control of South Carolina. Then Marion and Sumter commenced their fierce attacks on the foe, and continued them until the end of the war.

The Americans, under Gates, were defeated at Sander's Creek by Cornwallis, and Gates was replaced by Greene. Then followed the battle of King's Mountain, at which the English were defeated. Universal gloom pervaded the country, and, to make it worse, Benedict Arnold, through the arrest of Major Andre of the English army as a spy, was discovered to be a traitor. Andre was hung; but Arnold escaped to England, where he died.

Admiral Ternay and Count Rochambeau arrived in America with aid for the Americans in the July previous, but nothing of importance transpired until Holland acknowledged the independence of the colonies, and England thereupon declared war against her.

The Bank of North America was established in Philadelphia, Jan. 1, 1781. On the 17th of the same month the Americans routed the British at Cowpens Then Gen. Greene, by a series of masterly retreats, saved his army from annihilation, and reached Virginia.

On the 22d of August, Greene met and defeated the English at Eutaw Springs. About this time Gen. St. Clair drove the British from North Carolina.

De Grasse, with a French fleet, arrived Aug. 30, and the allied forces hemmed Cornwallis in Yorktown.

The siege of Yorktown opened on the 6th of October, and Cornwallis surrendered to Gen. Lincoln, whom Washington deputed to receive his sword, Oct. 19, 1781. The war ended in August, 1782, and the articles of peace were signed on Nov. 30, although Congress did not proclaim the peace till April 11, 1783. Meanwhile the foreign nations were sending in their acknowledgments of the independence of the States.

Washington disbanded the army Oct. 18, and issued his farewell address Nov. 2. He died Dec. 14, 1799. Jefferson and Adams became ministers to France and England, respectively, in 1785.

The finances of the country were in a serious condition, and anarchy seemed inevitable.

In May, 1787, a convention of the representatives of the different States was held in Philadelphia, which lasted till Sept. 28, when it adopted the Constitution of the United States, and submitted the same to the States for ratification.

Congress assembled for the first time under the new Constitution in the city of New York, March 4, 1789, and a national government was formed of the thirteen sovereign States.

George Washington was elected President thereof, and entered on his duties, April 30.

In 1790, Maryland ceded the District of Columbia to the United States for national purposes, and Congress moved to Philadelphia.

Benjamin Franklin died April 17, aged eighty-four.

A census taken that year showed the population to be about four millions. In the following year the United States Bank was chartered, Vermont was admitted as a State, and a revenue tax was laid on whiskey.

In 1792, Kentucky entered the Union, a daily newspaper was started, and a mint established.

In 1793, Washington entered on his second term, and death carried off John Hancock and Roger Sherman. Whitney invented the cotton-gin, which was of incalculable benefit to the country at that time.

France had experienced a revolution, and was trying to establish a republic, and as a matter of course had the sympathy of this country; but some looked with horror on the extremes to which many of the French carried matters. These people were fond of the English customs, and were called, in the parlance of the day, Federalists; while the French sympathizers were known as Republicans, and afterwards as Democrats.

Washington, John Adams, and Hamilton were Federalists, while Jefferson and Samuel Adams were Republicans. Hamilton sought to bring all power to the nation, Jefferson believed in the sovereignty of the States. It was the difference between the autocrat and the democrat.

John Adams took charge of the government from 1798 to 1801. War with France was imminent, but Bonaparte averted it.

The Alien and Sedition Laws were passed, which gave the President entire discretion in the regulation of the political action of foreign residents in this country, and the administration became decidedly unpopular.

Thomas Jefferson was third President of the United States, from 1801 to 1809.

Difficulties had arisen with England and France in commercial matters. England, furthermore, claimed the right to search American merchantmen for her subjects, and so acted.

Congress forbade commercial intercourse with England, which aroused the indignation of the merchants of this country, for it hurt them worse than it did the English.

The Barbary pirates captured some American vessels, and held the crews for ransom or sold them into slavery. This continued till Decatur taught them to respect the starry banner.

Jefferson worked hard to conduct the government on principles of honesty and common-sense, and none of the pomp which was prevalent in the terms of his predecessors was tolerated by him.

In 1807, Congress, on motion of Josiah Quincy, forbade the importation of slaves.

In this year, also, Robert Fulton launched his steamboat on the Hudson River.

Aaron Burr (who, while Vice-President, killed Alexander Hamilton in a duel, and thus brought himself into disfavor, and failed of a re-election with Jefferson, for a second term) started a conspiracy to seize some of the Southern States, invade Mexico, and form a new nation. He was arrested, tried, and acquitted; but he had forfeited the confidence and respect of the people.

Thomas Jefferson.

The territory known as Louisiana, which in 1803 extended from Canada to Mexico, and from the Mississippi to the Rocky Mountains, was purchased from France for $15,000,000 by the United States, and a party under Lewis and Clarke was sent to explore the territory. They returned in three years and made a glowing report of the new purchase.

James Madison, the fourth President, served from 1809 to 1817. Meanwhile England had persisted in searching our vessels, till six thousand American citizens had been seized and carried off.

The United States declared war against England on June 19, 1812. The Americans, under Hull, attacked the Canadas, but were defeated, and Detroit fell into the hands of the English. Te´cumseh, the celebrated Indian chief, incited the Indians to war on the Americans. The United States army was very unsuccessful, for some reason; but the navy covered itself with glory. On the 19th of August the American frigate "Constitution" captured and destroyed the English frigate "Guerriere." On the 18th of October the American sloop "Wasp" captured the English sloop "Frolic," and was herself captured by the English frigate "Poictiers." The British frigate "Macedonia" was captured off the Canary Islands. The British ship "Nocton," with $55,000 in specie, was captured, and the frigate "Java" destroyed. The "Chesapeake's" glorious but unsuccessful fight against the British frigate "Shannon" occurred June 1, 1813, off Cape Ann.

The British had control of the Great Lakes; but Com. Perry destroyed the British squadron, capturing six ships on Lake Erie, Sept. 10, 1813.

During the year 1814 the British burnt several places in the South, among which were the city of Washington and its public buildings. They essayed the capture of New Orleans, Jan. 8, 1815, but the city was saved by Gen. Jackson and his cotton bales.

Shortly after the war ended, for a treaty of peace had been signed at Ghent on the preceding 24th of December.

The treaty of Ghent never so much as mentioned "the right of search," which was the cause of the war. Possibly the result of the war wiped out any desire to insist on that right. For years after peace and plenty smiled on the land, and progress and improvement were the watchwords of the hour.

James Monroe was called to the Presidential chair in 1817, and retired from it in 1825. This term is remembered as the "era of good feeling," although the Seminole Indians of Florida made some trouble, which led to a dispute with Spain, which finally sold Florida to the United States for $5,000,000.

Missouri applied for admission to the Union in 1818, and thus opened the agitation of the slavery question, which continued with varying bitterness till the Civil War removed the "bone of contention" in 1865.

President Monroe, in his annual message to Congress, in 1822, announced that, in the future, America was not to be colonized by any European power. This is called the "Monroe doctrine."

In 1824, La Fayette revisited the country and every honor was paid him.

John Q. Adams, of Massachusetts, was President from 1825 to 1829, and was the first President who had not been connected with the Revolution.

NEW ORLEANS.

On July 4, 1826, Ex-President John Adams and Thomas Jefferson died, within a few hours of each other.

During Mr. Adams's administration a heavy protective tariff was adopted by Congress, "to protect our infant industries."

The Creek Indians were sent beyond the Mississippi.

The first railroad built in the United States was started at Quincy, Mass., and the canal system was pushed to completion in the region of the Great Lakes.

Andrew Jackson guided the ship of state from 1829 to 1837. He was the choice of the "low-tariff" party.

South Carolina, thinking that the high tariff favored Northern manufacturers at the expense of the Southern planters, undertook to remedy matters by declaring the tariff law null and void within her borders, and passed an ordinance of secession in 1832.

John C. Calhoun, her favorite son, was to be president of the new confederacy; but Jackson denied the right of any State to secede, and backed his opinions by sending the army and navy to South Carolina, which tended to subdue the secessionists. Congress soon after reduced the duties complained of, to the great satisfaction of the South.

The Seminole Indians of Florida, under Osceola, continued troublesome for many years, until their tribe was nearly extirpated.

In 1831, Lundy and Garrison commenced their crusade against slavery, and in 1832 the Anti-Slavery Society was formed.

Jackson promulgated the doctrine, "To the victors belong the spoils," which doctrine he observed in the distribution of offices, as have all his successors.

Martin Van Buren, of New York, succeeded to the Presidency in 1837. During his term the slavery question caused much excitement, and Abolitionists were the recipients of more censure than praise.

A financial panic swept over the country in 1837, failures were common, and great distress prevailed.

Van Buren's administration was very unpopular, and when he was renominated for a second term the Whigs nominated William Henry Harrison, of Ohio, and John Tyler, of Virginia. The Democrats alleged that Harrison would rather have a "log-cabin and a barrel of hard cider than the Presidency." The Whigs caught up this saying, and this most exciting and bitter contest in the political annals of the country has come to be known as the "Log-cabin and hard-cider campaign."

Harrison was elected; but "Tippecanoe," as his admirers styled him, lived but a month after his inauguration.

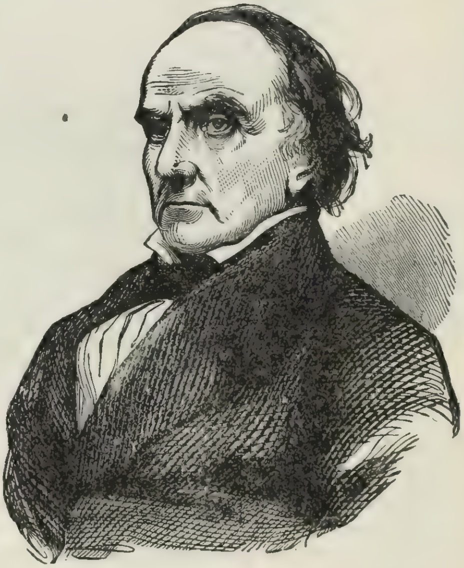
John Tyler succeeded to the Presidential chair. His policy was a disappointment to his party, and he became unpopular.

Peace was maintained with the foreign powers, but internal troubles, such as Dorr's rebellion against the colonial laws of Rhode Island in 1842; the "no-rent" riots in New York; Mormon troubles in Nauvoo, Ill.; and the diversity of opinions existing between the President and Congress, tended to keep the public mind in a state of excitement.

The celebrated Webster-Ashburton treaty, by which our New England boundary was defined, was ratified in 1842, and Daniel Webster received great credit for his labors in that affair.

Florida was admitted to the Union, and Texas annexed, in 1845.

James K. Polk entered on his Presidential term during this year, and in 1846 a peaceful settlement of the northwestern boundary was attained, the line being drawn at 49° north latitude.



Danl Webster

The dispute as to the true boundary of Texas led to the war of 1848 between the United States and Mexico.

Victory seemed to favor the United States from the start; for its armies, under Taylor and Scott, were uniformly successful. The laurels won at Palo Alto, Resaca de la Palma, Monterey, Buena Vista, Cherubusco, Molino del Rey, Chapultepec, will ever remain green.

The war closed in just two years from its inception by the treaty of Guadalupe Hidalgo, Feb. 2, 1848, by which New Mexico and Upper California were ceded to the United States, and the Rio Grande became the southwestern boundary line of the United States.

John C. Fremont was at this time exploring California, and the rush for the gold mines set in when his reports reached the East that gold had been discovered.

The anti-slavery men joined hands and formed the Free-Soil party. Gen. Zachary Taylor, of Kentucky, "Old Rough-and-ready," as his soldiers in the late war loved to call him, was elected President by the Whig party, and was inaugurated March 5, 1849; but died July 9 of the following year, and Vice-President Millard Fillmore became his successor.

San Francisco.

The slavery question was now the all-absorbing topic. Henry Clay tried to pour oil on the troubled waters by a series of compromise measures, which were embodied in the Omnibus Bill; among which were the abolition of slavery in the District of Columbia, the admission of California as a free State, and one for the recapture of fugitive slaves.

The former two were adopted as in keeping with the spirit of liberty; but the fugitive-slave part, which gave owners the right to retake their slaves in any place without a jury trial, was violently opposed and denounced by Charles Sumner, Wendell Phillips, Horace Mann, Theodore Parker, and others. Daniel Webster indorsed it as legally right; and it became a law in September, 1850, and caused a great deal of trouble in the North.

Franklin Pierce of New Hampshire, a Democrat, was the next President, 1853–1857. During his administration the Missouri Compromise of 1820 was repealed, and the Territories were allowed to decide for themselves on the slavery question.

In consequence of this, both political parties colonized the new Territories with their adherents. A civil war broke out in Kansas, between the Abolitionists and the Border Ruffians, as their opponents were called.

James Lane led the forces of the Free-Soilers, and Capt. John Brown distinguished himself at the defence of Ossawattomie. Bloodshed was an every-day affair, and Kansas was long known by the soubriquet of "Bleeding Kansas." At last, justice triumphed, and Kansas and Nebraska were saved from the pollution of slavery.

Arizona and New Mexico were purchased from Mexico, in 1853, for $10,000,000, it having been found that the Guadalupe treaty did not give the United States a clear title to them.

Com. M. C. Perry compelled the Japanese to remove nearly all their restrictions on commerce with this country, and thus opened her ports to the world on March 4, 1854.

James Buchanan, of Pennsylvania, was President from 1857 to 1861. In the first year of his term the Supreme Court rendered the famous Dred Scott decision, which declared that the owner of slaves could take them into any part of the country. This threw the North into a frenzy.

Soon afterwards, John Brown, of Kansas, undertook to free the slaves of Virginia. With a small body of men he seized Harper's Ferry and the United States Arsenal, Oct. 16, 1859, and after a plucky resistance surrendered to the United States troops. Brown was hung, Dec. 2, 1859.

This had the effect of bringing matters to a climax, and the next election found four parties in the field. Douglas, Lincoln, Breckenridge, and Bell were the nominees for President. The choice fell on the second of these, Abraham Lincoln of Illinois. He was very conservative in his views, but he represented the elements which were radical in their opposition to slavery; hence the South, fearing for their "institutions," proceeded to leave the Union, South Carolina setting the example, under the plea of State sovereignty, or State rights.

Abraham Lincoln.

South Carolina seceded Dec. 20, 1860, and was followed by Mississippi, Florida, Alabama, Georgia, Louisiana, Texas, North Carolina, Virginia, Arkansas, and Tennessee, in the order named. Jefferson Davis, of Mississippi, was President, and Alexander H. Stevens, of Georgia, Vice-President of these Confederate States. South Carolina took possession of all United States property within her limits, save Fort Sumter, which Major Robert Anderson refused to surrender at Beauregard's request, whereupon the latter commenced an attack upon Sumter, April 12, 1861. Anderson surrendered at the end of two days, deeming further resistance useless.

The fall of Sumter brought matters to a crisis. The President called for 75,000 volunteers for three months. On the following day several regiments of State militia responded to the call, and the Sixth Massachusetts were stoned, and three of its members killed, while passing through Baltimore, April 19, 1861.

In May the Federal troops went to Alexandria. Fighting soon commenced, and the Union troops were successful in West Virginia, under McClellan.

After the defeat at Big Bethel, Lieut.-Gen. Scott moved toward Richmond, but was defeated at Bull Run, July 21. Gen. Lyon had more success in his efforts in North Missouri, for he drove the rebels out of the State.

On the coast, Fort Hatteras, Port Royal, Beaufort, and Roanoke surrendered to Com. Gouldsboro, and were subsequently held by the Union forces. Scott was relieved from command of the army, and Gen. George B. McClellan was appointed in his stead.

In 1862, McClellan took the Army of the Potomac as far as Fair Oaks, on his way to Richmond, where they were met by the Confederates and repulsed May 31, 1862. Re-enforcements coming to the Union troops, the Confederates were driven into Richmond, which was but six miles distant.

McClellan now changed his base of operations to the James River; and then followed the seven days' fight of the peninsula, of which the battle of Malvern Hill, July 1, 1862, was the most severe, and resulted in the defeat of the Confederates, though Gen. McClellan was obliged to retreat.

Gen. Banks left the Shenandoah Valley to cover McClellan's change of base, and then came the battles of Cedar Mountain and second Bull Run.

Gen. Lee crossed the Potomac into Maryland, where McClellan met and defeated him at Antietam, Md., Sept. 17, 1862. This was one of the hottest and most bitterly contested battles of the war. Lee withdrew into Virginia. McClellan was blamed for not following up his advantage, and he was relieved of his command, and Ambrose E. Burnside appointed in his stead, Oct. 7.

Gen. George B. McClellan.

By the navy the war had been prosecuted as vigorously as the deficient state of its armament would allow. The Southern ports were blockaded, and Messrs. Mason and Slidell, Confederate envoys, sent to seek aid from England and France, were taken from the English mail steamer "Trent," by Com. Wilkes, Nov. 8, 1861; but as this was in violation of the principles of international law, they were released.

The Confederate ram "Merrimac" was sent to destroy the United States vessels in Hampton Roads, and she sank the "Cumberland," burned the "Congress," and ran the "Minnesota" aground.

That night Ericsson's "Monitor," under command of Capt. Worden, entered on the scene, and the following morning these two experimental war vessels pounded each other with shot and shell for five hours without apparent effect; finally a shell from the "Monitor" entered the "Merrimac's" port-hole, killing several of the crew, and the ram retreated. This gave an impetus to the building of iron-clad ships.

Fort Pulaski, Fla., Fort Henry, Tenn., Fort Donelson, on the Cumberland River, Nashville, and Island No. 10 surrendered to the Union forces.

Gen. U. S. Grant defeated the Confederates after a severe fight at Shiloh, or Pittsburg Landing, as it is sometimes called; and Memphis surrendered to the Union navy, June 6.

Admiral Farragut ran by and silenced Forts Jackson and St. Philip, and took possession of New Orleans, April 25. The forts surrendered on the 28th.

A brilliant victory over the Confederate Gen. Price was gained by Gen. Rosecrans, at Iuka, on the 19th of September; and he was again successful on the 22d of January, 1863, in the sanguinary battle of Murfreesboro.

Sept 22, 1862, the President issued a proclamation, declaring that all persons held in slavery would be freemen after Jan. 1, 1863. Colored regiments were now organized, South Carolina and Kansas being the first to send colored troops to the field.

1863 opened with a proclamation from the President, confirming the one of Sept. 22, and declaring the slaves free.

Gen. Burnside did nothing till Dec. 12, when he crossed the Rappahannock River, and on the 13th the first battle of Fredericksburg was fought. Night came on, and the useless carnage ended by the withdrawal of the Union army, utterly demoralized.

"Fighting Joe" Hooker succeeded Burnside in command of the Army of the Potomac, and was terribly beaten at Chancellorsville, May 2, by Gens. Lee and Jackson. The Confederates lost "Stonewall" Jackson, one of their most beloved and successful generals.

Gloom prevailed in the North. The prospects of saving the Union looked bad, and desertions from the army were of frequent occurrence. Large bounties were offered by the government for recruits, and "bounty jumpers," who enlisted for money only, deserted and re-enlisted as many times as possible.

Drafts were ordered throughout the loyal States, and they became decidedly unpopular. Encouraged by this state of affairs, Lee swept through the Shenandoah and across the Potomac into Maryland.

GENS. "STONEWALL" JACKSON AND ROBERT E. LEE.

On July 1 the Confederates encountered the Union army, under Gen. George Meade, at Gettysburg; and after a three-days' battle, Lee was beaten, and retreated into Virginia. This battle is considered as the turning-point of the war.

On the same day that victory crowned Meade's efforts, Vicksburg surrendered to Gen. Grant, after forty-seven days' siege; Port Hudson followed, thus opening the Mississippi River.

Meanwhile the drafts in the North were growing more unpopular, and riots broke out in New York and other large cities; but order was restored, after some trouble and loss of life.

Gen. Rosecrans suffered a severe defeat at Chickamauga, and was besieged at Chattanooga. Gen. Grant relieved him and drove the confederates out of Tennesee.

In 1864, Gen. Banks led an expedition up the Red River, got badly mixed up, defeated, and driven back at the same time. The guerilla Forrest captured Fort Pillow, and massacred three hundred colored soldiers.

Gen. Grant was appointed lieutenant-general in command of the armies of the United States, March 17, 1864. He directed Gen. W. T. Sherman to march from Atlanta to the sea; while Meade was to lead the Army of the Potomac on to Richmond. Sherman went through Georgia, carrying everything before him, till he reached Savannah.

GEN. U. S. GRANT.

In May and June, Grant's losses in the battles of the Wilderness, Spottsylvania, and Cold Harbor were enormous, amounting to 70,000. He laid unsuccessful siege to Richmond. Gen. Sheridan by his ride of twenty miles turned the defeat of Winchester into a victory.

The Confederate privateers, the best known of which were the "Shenandoah" and "Alabama," captured and destroyed nearly three hundred American vessels. The career of the "Alabama" was stopped by the "Kearsarge" near Cherbourg, off the coast of France, June 19, 1864. Capt. Semmes, the commander, escaped on a British yacht.

Admiral Farragut disabled and captured the "Tennessee" in Mobile Harbor; and the "Albemarle" was destroyed by Lieut. Cushing, Oct. 27, 1864.

In the early part of 1865, Sherman left Savannah and marched north to Goldsboro', where he arrived on the 23d of March. Charleston, S. C., succumbed, Feb. 17, after five hundred days' siege, and Fort Fisher also fell. Grant commenced a forward movement on March 29, 1865. On April 1, Sheridan turned Lee's flank at Five Forks and captured 5,000 prisoners. The Union forces took possession of Petersburg and Richmond two days after, and Lee surrendered his famished and exhausted army, April 9, 1865, at Appomattox Court House. thus bringing the war to an end.

Five days after the glad tidings of peace had been proclaimed, Wilkes Booth shot President Lincoln, and the country was plunged in mourning. Vice-President Andrew Johnson at once took the oath of office as President.

Shortly after, Congress passed a joint resolution prohibiting slavery in any part of the country, and submitted it to the States, twenty-seven of which ratified it as an amendment to the Constitution.

On May 29, President Johnson granted amnesty to nearly all persons engaged in the rebellion. He held that the States could not secede; hence that they were never out of the Union. Congress thought differently, and proposed to reconstruct the affairs of the South, passing several measures in accordance with their views. Johnson vetoed them, but they were passed over his veto.

The House of Representatives impeached the President, and demanded his removal. He was tried by the Senate, and acquitted May 26, 1868. William H. Seward, Secretary of State, negotiated the purchase of Alaska, from the Russian government, for $7,000,000.

U. S. Grant became President in 1869.

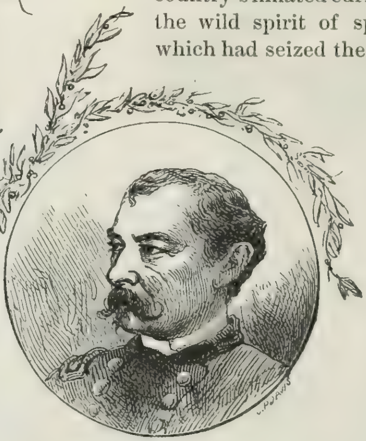
The treaty for the settlement of American claims against England, by which it was agreed that all claims for damages by either nation against the other should be submitted to arbitrators, to be appointed by friendly nations, was ratified. The appointed arbitrators met at Geneva, in Switzerland, in 1872; the case was fully heard, and the sum of $15,500,000 was awarded the United States. The privateer "Alabama" having caused the most damage, the claims have come to be known as the "Alabama Claims."

In 1872 several of the prominent leaders, such as Sumner, Greeley, and Charles Francis Adams, of the Republican party, left its ranks; and Greeley led the dissenters and Democrats in the Presidential campaign against Gen. Grant, who was victorious, as usual.

During this year the government sought to remove the Modoc Indians to a new reservation against their will, producing an outbreak among the Indians, which lasted over five months and caused the loss of many valuable lives.

In 1873 occurred one of the most disastrous monetary panics ever known in the United States. Business was paralyzed, and months elapsed before confidence was restored sufficiently to allow capitalists to engage in usual transactions. The primary cause of the panic was the country's inflated currency, and the wild spirit of speculation which had seized the people.

Gen. Wm. T. Sherman.



Gen. Phil. Sheridan.

On May 10, 1876, the Centennial International Exhibition was opened at Philadelphia, with all the pomp and splendor that its progenitors could devise. The exhibition closed Nov. 10, having achieved a grand success.

Gold was discovered in the Black Hills, a part of the Sioux reservation, which the Indians by treaty agreed to vacate on or before Jan. 1, 1877. The gold hunters would not wait for this, and hordes of miners and adventurers rushed thither; thus precipitating a conflict with the Indians, who proceeded, under the leadership of Sitting Bull, to raid the neighboring Territories of Montana and Wyoming.

The government sent troops under Gens. Terry, Crook, Custer, and Reno against them. Custer found the Indians, June 25, on the Little Horn River, and without waiting for re-enforcements attacked them, the result being his own death and that of every man in his command. This was the most sanguinary Indian battle ever fought.

Vigorous measures were now taken to punish the Sioux, and after suffering many defeats, those remaining with Sitting Bull crossed the border into Canada.

In the Presidential contest which occurred in 1876, Samuel J. Tilden was the candidate of the Democrats, R. B. Hayes of the Republicans, and Peter Cooper of the Greenback party. The real contest was between the two former parties, and when the votes were counted both claimed the victory, and both raised the cry of fraud; the public mind was in a state of great excitement and perplexity, and serious trouble was feared. The settlement of the difficulty was finally referred to a "Joint High Commission," consisting of fifteen persons, selected equally from the House, the Senate, and the Supreme Court, whose decision was to be final. This body, two days before the time set by the Constitution for the inauguration, decided in favor of R. B. Hayes; and thus the greatest political crisis in the annals of the country was passed without violence.

President Hayes inaugurated a policy of conciliation, which he continued throughout his term.

During the summer and fall of 1877, strikes were of frequent occurrence, and that of the railroad employés caused great loss of life and property. The authorities were defied in several of the States, and the military had to be called out to put an end to the reign of terror thus inaugurated. In 1878, Congress passed a bill making the silver dollar legal tender, and this was called the remonetization of silver.

In accordance with the provisions of the treaty of Washington, a commission of three was appointed to consider what amount, if any, the United States ought to pay Great Britain for the benefits accruing from the fisheries on the coast of the British provinces. The commission, which sat at Halifax, N. S., decided that the United States should pay Great Britain the sum of $5,000,000.

This decision was looked upon in this country as decidedly unjust, as it was asserted that England had the best of the bargain from the beginning. However, the award was paid.

On Jan. 1, 1879, the government resumed specie payments, with none of the difficulties which some would-be financiers had predicted.

J. A. Garfield became President of the United States, March 4, 1881. At the very beginning of his term the members of the two great parties in the Senate engaged in a struggle for the control of its organization; a dead-lock ensued, which was finally broken by a compromise.

A further complication arose when Senators Conkling and Platt resigned their seats in the Senate, because the President appointed a collector of New York who was obnoxious to them. These gentlemen expected a vindication from the Legislature of their State, but their expectations were not realized.

President Garfield was shot on the morning of July 2, 1881, by Charles Guiteau, in the station of the Baltimore and Potomac Railroad, in Washington. The assassin was immediately arrested and imprisoned.

Every known means was used for the alleviation of the President's suffering, and every effort made for his restoration to health. He was, at his own request, removed to Long Branch, where he died Sept. 19, 1881.

Chester A. Arthur.

Expressions of sorrow were almost universal throughout the world. On the eve of this day, Sept. 19, Vice-President Chester A. Arthur, in his own parlor, took the oath of office as President; and the formal inauguration took place in Washington on the 22d of the same month.

Guiteau had a protracted trial, was found guilty, and was hanged June 30, 1882.

In September of this year, Lieut. Danenhower, Engineer Melville, and other survivors of the ill-fated "Jeannette" Arctic exploring party, returned home. This expedition was fitted out by the New York *Herald* to search for an open polar sea, but the vessel was crushed in the ice, June 23, 1881, in latitude 77° north, and longitude 159° east, or 150 miles northeast of the island of New Siberia. The crew left the ship in three parties, under Capt. De Long, Lieut. Danenhower, and Engineer Melville. Capt. De Long and his party died of starvation after the most fearful sufferings; their bodies were found and buried.

The famous Star Route trials, which was an attempt on the part of the government to bring several prominent public men to justice for gigantic frauds in certain mail contracts, resulted, on Sept. 11, 1882, in a verdict convicting two of the least important parties implicated, and in a disagreement as to all the principals.

The verdict was looked upon as absurd by the country at large. Bribery was charged and generally believed. The court set aside the verdict and ordered a new trial.

This year Congress passed a bill appropriating over $18,000,000 for the improvement of the rivers and harbors of the country. The President for good reasons vetoed the bill, but Congress passed it over the veto. The fall congressional elections indicated very plainly that the people sustained the veto. Civil-service reformers are much encouraged by the results of these elections.

CHRONOLOGY OF THE UNITED STATES.

1492 Oct. 12, Columbus discovered one of the West Indies.
1497 July 3, the Cabots discovered Labrador.
1498 Sebastian Cabot explored the coast from Labrador to Florida.
1512 April 6, Ponce de Leon landed at Florida.
1534–35 Cartier takes possession of the country through which flows the St. Lawrence River.
1539–41 De Soto took possession of the Gulf States, and discovered the Mississippi.
1540–42 Cabrillo explored the Californian coast.
1562 Ribault built Fort Carolina, at Port Royal, S. C., which was the first attempted colonization of the United States.
1565 At St. Augustine, Fla., the Spaniards established the first permanent settlement.
1582 Espejo founded Sante Fé, the second oldest town in the United States.
1583–87 Raleigh made three expeditions to Virginia, and twice attempted to plant a colony at Roanoke.
1602 Gosnold discovered and named Cape Cod.
1603 De Monts received from Henry IV., of France, a grant of "Acadia" (including the whole coast from Delaware Bay to the Gulf of St. Lawrence), and he established a permanent settlement at Port Royal, Nova Scotia.
1607 The English settled at Jamestown, Va., May 23, under charter of London Company.
1609 Hudson discovered the river which bears his name. — Champlain discovered Lake Champlain.
1613–14 New York settled by the Dutch.
1619 The first representative assembly in America was called by Gov. Yeardley, at Jamestown, Va.
1620 Dec. 21, Plymouth, Mass., settled by the English.
1621 Massasoit (chief of the Wampanoag Indians) makes a treaty with Plymouth Colony.
1622 The settlers at Jamestown massacred by the Indians.
1623 New Hampshire settled at Dover and Portsmouth, under grant to Gorges and Mason.
1624 New Jersey settled at Bergen, by the Dutch and Danes.
1627 Delaware settled at Cape Henlopen, by the Swedes.
1628 March 4, charter granted to Massachusetts Bay Colony.
1630 July 1, first house built in Boston, under Gov. Winthrop.
1633 Maryland granted to Lord Baltimore.
1634 Maryland settled at St. Mary's.
1633–36 Connecticut settled at Windsor Hartford, and Wethersfield.
1636 Rhode Island settled at Providence, by Roger Williams.
1637 War between the Pequod Indians and the Connecticut settlers.
1638 New Haven Colony founded. — Harvard College founded.
1641 New Hampshire united with Massachusetts.
1643 May 29, union of the New England Colonies.
1663 North Carolina settled by the English at Albemarle.

1664 New Netherlands taken by the English, and its name, Manhattan, changed to New York.
1669 Wisconsin settled at Green Bay by the French.
1670 Michigan settled at Detroit.
1675–76 King Philip's war.
1680 New Hampshire separated from Massachusetts.
1682 Pennsylvania settled at Philadelphia, by William Penn.
1685 Arkansas settled at Arkansas Post, by the French.
1692 Salem witchcraft.
1700 Yale College founded.
1704 First newspaper published in America, in Boston ("Boston Weekly News-Letter") — Deerfield burned by the Indians and French.
1711 Alabama settled at Mobile by the French.
1716 Mississippi settled at Natchez by the French.
1720 Illinois settled by the French at Kaskaskia.
1732 Feb. 22, George Washington born in Virginia.
1733 Georgia settled at Savannah, by the English.
1744–48 War in America between England and France, called "King George's war."
1756–63 French and Indian war, ending in the complete subjugation of the French in America.
1764 The English Parliament re-enacted the Sugar Act.
1765 Stamp Act passed. — First Colonial Congress met in New York and framed a declaration of rights.
1766 Stamp Act repealed.
1767 Duties laid on tea, glass, paper, and painters' colors.
1768 Military force, under Gen. Gage, stationed in Boston.
1773 Dec. 16, destruction of tea in Boston Harbor.
1774 Boston Port Bill passed.
Sept. 5, First Continental Congress met at Philadelphia, and passed a declaration of rights.
1775 April 19, battle of Lexington.
May 10, Ticonderoga taken by Allen and Arnold.
May 12, Crown Point taken by Allen and Arnold.
June 15, Washington appointed commander-in-chief.
June 17, battle of Bunker Hill.
July 2, Washington took command of troops at Boston.
1776 March 17, Boston evacuated by the British troops under Howe.
July 4, Declaration of Independence. — Commissioners sent to France to solicit assistance.
1778 Feb. 6, American independence acknowledged by France.
1781 Oct. 19, Cornwallis surrendered at Yorktown to the combined French and American forces.
1782 Treaty with Holland.
1783 Sept. 3, treaty of peace with England signed at Paris
Dec. 23, Washington resigned his commission.
1787 Sept. 17, Constitution of the United States adopted in convention at Philadelphia, Pa
1788 Constitution ratified by all the States except North Carolina and Rhode Island.
1789 First Congress under the Constitution.
April 30, George Washington inaugurated President.
1790 Duties laid on tonnage, imported goods, and distilled spirits. — Hamilton's funding system adopted.
1791 Vermont admitted into the Union, March 4. — United States Bank and Mint established at Philadelphia. — Charter of bank expires 1836.
1792 Kentucky admitted into the Union, June 1.
1794 Whiskey insurrection in Pennsylvania — Great Britain seized American vessels and impressed American seamen.
1795 June 24, Jay's treaty ratified.
1796 June 1, Washington's "Farewell Address." — Tennessee admitted into the Union.
1797 March 4, John Adams inaugurated.
1798 Alien and Sedition Acts passed.
1799 Dec. 14, death of Washington.
1800 Seat of government removed to Washington. — Treaty of peace with France.
1801 March 4, Thomas Jefferson inaugurated.
Repeal of the Alien and Sedition Acts. — Tripoli declares war against the United States.
1802 Nov. 29, Ohio admitted into the Union.
New Orleans closed against the United States.
1803 Louisiana purchased from France for $15,000,000.
1804 July 11, Alexander Hamilton killed in a duel by Aaron Burr.
1805 Treaty of peace with Tripoli.
1807 Congress lays embargo on American ships.

1808 Commencement of steam navigation, by Fulton, on the Hudson. — Foreign slave-trade ceased.

1809 James Madison inaugurated.

April 19, embargo law repealed.

Aug. 10, non-intercourse with England again proclaimed.

1811 Nov. 7, Gen. Harrison defeats the Indians at Tippecanoe.

1812 April 8, Louisiana admitted into the Union.

June 19, war declared against England.

Aug. 19, British frigate "Guerriere" taken by the "Constitution" ("Old Ironsides").

1813 Sept. 10, Perry's victory on Lake Erie.

1814 March 27, Creek war ended by the battle of Horseshoe Bend (Tohapeka).

Dec. 14, treaty of peace with England, at Ghent.

1815 Jan. 8, battle of New Orleans.

Feb. 17, treaty of peace ratified. — War with Algiers.

1816 Dec. 11, Indiana admitted as a free State. — United States Bank rechartered for twenty years.

1817 Dec. 10, Mississippi admitted as a slave State.

March 4, James Monroe inaugurated.

1818 Dec. 3, Illinois admitted as a free State.

1819 Dec. 14, Alabama admitted as a slave State. — Florida purchased of Spain. — Treaty with England concerning fisheries and northern boundary.

1820 March 3, Missouri Compromise passed.

March 15, Maine admitted as a free State.

1821 Aug. 10, Missouri admitted as a slave State.

1824 La Fayette visits the United States.

1825 March 4, John Q. Adams inaugurated. — Henry Clay, Secretary of State.

1826 July 4, John Adams and Thomas Jefferson died.

1827 First railroad finished in the United States (four miles long, at Quincy, Mass.).

1828 Duties on imported goods increased.

1829 March 4, Andrew Jackson inaugurated.

1832 Black Hawk War. — Nullification in South Carolina stamped out by Jackson. — Clay's compromise providing for a gradual reduction of duties.

1833 Removal of United States funds from United States Bank to State banks (Wm. J. Duane, Secretary of the Treasury, dismissed for refusing to make the removal).

1835 National debt extinguished.

1836 "Specie circular" issued, requiring all payments to government in specie.

1836 June 15, Arkansas admitted as a slave State.

1837 Jan. 26, Michigan admitted as a free State.

March 4, Martin Van Buren inaugurated.

Great money pressure; banks suspended specie payments, May 10, and resumed Aug. 13. — War with the Seminole Indians.

1840 Independent Treasury Bill passed; repealed in 1841.

1841 March 4, William H. Harrison inaugurated; April 6, John Tyler inaugurated, on death of Harrison.

1842 Northeastern boundary determined by the commissioners, Daniel Webster and Lord Ashburton. — Dorr's rebellion.

1845 March 4, James K. Polk inaugurated.

Texas becomes United States territory by accepting the resolutions of Congress. — Texas and Florida admitted as slave States. — Gen. Taylor sent to defend Texas.

1846 Dec. 28, Iowa admitted as a free State.

Subtreasury, warehousing, and Smithsonian Institution bills passed. — Tariff law of 1842 repealed. — Northwestern boundary settled (Buchanan and Packenham, commissioners).

May 11, war declared against Mexico.

1848 May 29, Wisconsin admitted as a free State.

Feb. 2, treaty of peace with Mexico, at Guadalupe Hidalgo.

The Mormons settle at Salt Lake City.

Gold discovered in California, February.

1849 March 4, Zachary Taylor inaugurated.

1850 July 16, Millard Fillmore inaugurated, on account of death of Taylor, July 9.

Sept. 9, California admitted as a free State.

Abolition of the slave trade in the District of Columbia. — Fugitive Slave Law passed.

1851 Postage on letters reduced to three cents for distances of three thousand miles or less.

1852 Death of Daniel Webster and Henry Clay.

1853 March 4, Franklin Pierce inaugurated.

1854 Com. Perry's treaty with Japan. — Repeal of the Missouri Compromise and passage of the Kansas-Nebraska Bill.

1857 March 4, James Buchanan inaugurated.

1858 May 11, Minnesota admitted as a free State.

1859 Feb. 14, Oregon admitted as a free State.

1860 Dec. 20, South Carolina seceded. — Cabinet officers, United States senators, and members of Congress from Southern States resigned.

1861 Jan. 9, steamer "Star of the West" fired upon.

New York banks suspended specie payment.

1861 Jan. 29, Kansas admitted.

Feb. 4, Southern Confederacy formed at Montgomery, by the seven seceded States.

Feb. 4, Jefferson Davis chosen President of the Confederacy.

March 4, Abraham Lincoln inaugurated.

Virginia, Arkansas, North Carolina, and Tennessee joined the Confederacy.

April 12, Fort Sumter fired upon.

April 15, Lincoln called for 75,000 volunteers.

April 19, Massachusetts troops fired upon in Baltimore. — West Virginia cut off from Virginia.

July 20, Confederate Congress assembled at Richmond, Va.

July 21, first battle of Bull Run. — Gen. Scott resigned, and George B McClellan was appointed commander-in-chief.

1862 Lincoln called for 300,000 more troops.

June 3, Lee assumed command of the Confederate armies.

Sept. 17, battle of Antietam.

Dec. 31, West Virginia admitted as a State.

1863 Jan. 1, proclamation of emancipation.

Jan. 25, first United States colored regiment enrolled.

May 8, general draft of 300,000 men ordered.

July 1–3, battle of Gettysburg.

July 13–15, anti-draft riots in New York City.

Aug. 19, suspension of *habeas corpus.*

1864 Feb. 1, draft of 500,000 men ordered.

March 2, Gen. Grant appointed commander-in-chief.

March 15, Lincoln called for 200,000 men.

May 5 and 6, battle of the Wilderness, Va.

Aug. 5, great naval victory by Farragut at Mobile, Ala.

Oct. 31, Nevada admitted into the Union.

Nov. 1, postal money-order system established.

Nov. 14, Sherman began his march to the sea.

1865 April 2 and 3, Petersburg and Richmond taken.

April 9, Lee's army surrendered.

April 14, President Lincoln shot; died April 15.

April 15, Andrew Johnson inaugurated.

April 26, Johnston's army surrendered.

April 29, restrictions on commerce with the South removed.

May 11, Jefferson Davis captured.

May 29, proclamation of amnesty, with certain exceptions.

Dec. 18, Thirteenth Amendment, abolishing slavery, declared adopted.

1867 March 1, Nebraska admitted as a State. — Tennessee restored to the Union.

October, Alaska purchased.

1868 March 3, President Johnson impeached by the House; May 26, acquitted by the Senate.

June 24, seven States restored to the Union over the President's veto.

July 28, Fourteenth Amendment adopted. — Treaty with China.

1869 March 4, U. S. Grant inaugurated.

Sept. 24, monetary panic produced in New York City by gold brokers.

1870 March 30, Fifteenth Amendment declared adopted.

1872 Sept. 14, Geneva award to the United States was $15,500,000.

1873 September, most disastrous financial panic began.

1875 January, Resumption Act passed, declaring specie payments, Jan. 1, 1879.

March 3, Colorado admitted as a State.

1876 May 10, opening of the Centennial Exhibition.

1877 March 4, Rutherford B. Hayes inaugurated.

1881 March 4, James A. Garfield inaugurated.

July 2, President Garfield shot; died Sept. 19.

Sept. 20, Chester A. Arthur inaugurated.

1881 Centennial celebration at Yorktown Sept. 19.

1883 Ohio River overflows; floods Cincinnati and other places Feb. 13.

Brooklyn, N. Y., Bridge open to traffic May 24.

Completion of Northern Pacific R. R. Sept. 8.

New Standard Time adopted Nov. 18.

1884 Grant & Ward fail May 7. — Panic on Wall street May 14.

Republican Convention nominates J. G. Blaine for President June 6.

Stephen Grover Cleveland, Democratic Nominee, elected President of the U. S. over James G. Blaine, Republican Nominee, Nov. 10, 1884. — Cleveland Inaugurated March 4, 1885.

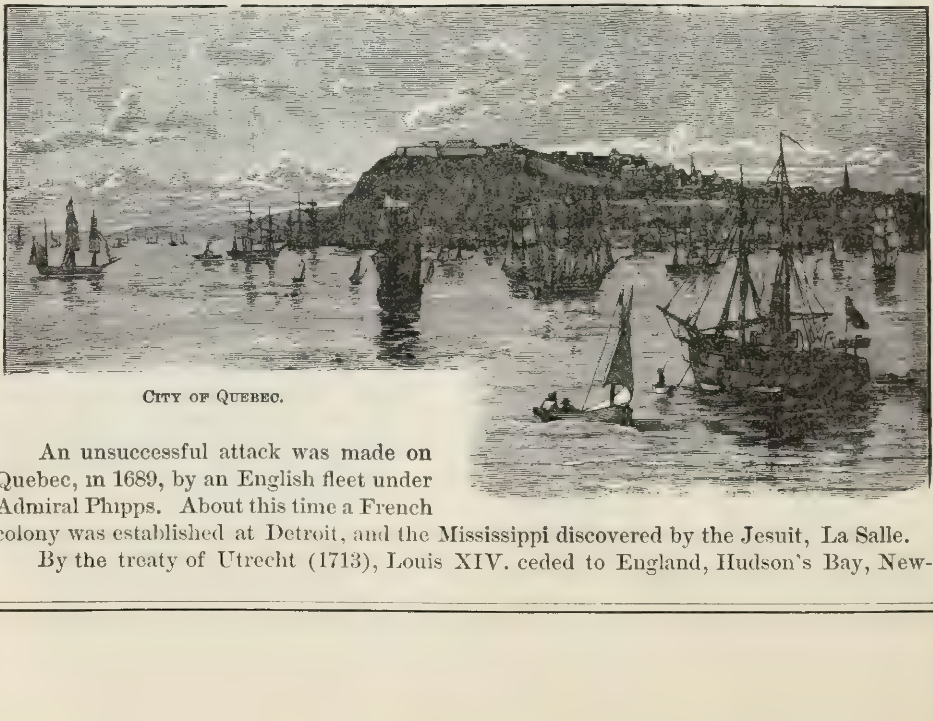
CANADA

JACQUES CARTIER, or Quartier, a French navigator, discovered Canada, and took possession of the country in the name of his sovereign, in 1534. In the following year he returned and explored the river separating Canada from the United States, and named it the St. Lawrence, from having entered it on the festival of that saint.

The country was inhabited at the time by various tribes of Indians, the principal of which were the Iroquois and Hurons.

A second French navigator, named Champlain, made further explorations of the country, and founded Quebec in 1609. It was taken by the English in 1629, but was restored to France in 1632, by the treaty of St. Germain-en-Laye.

The colonists made friendly treaties with most of the Indian tribes, but were frequently at war with the Iroquois, who dwelt south of the Lakes.



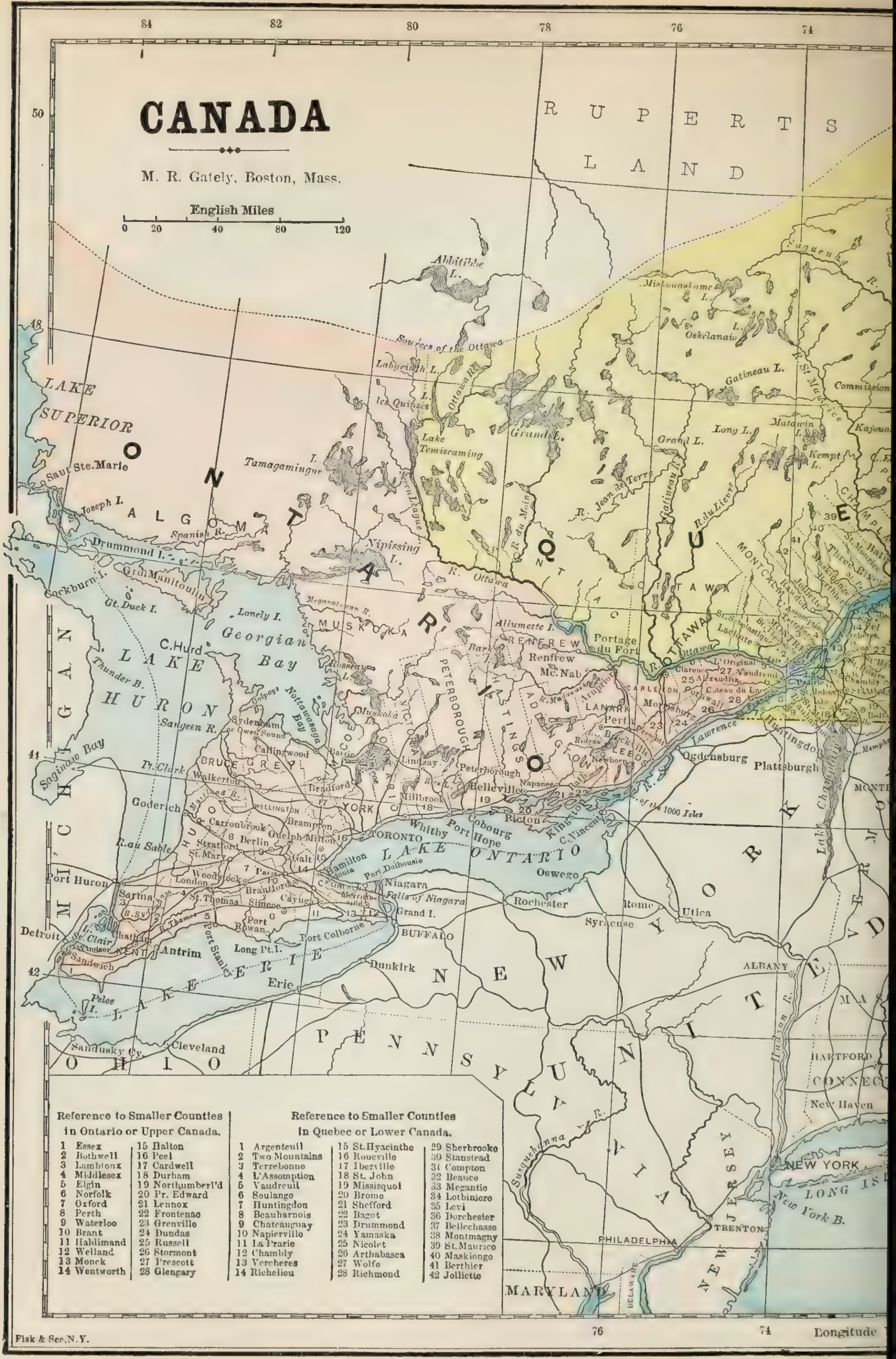
City of Quebec.

An unsuccessful attack was made on Quebec, in 1689, by an English fleet under Admiral Phipps. About this time a French colony was established at Detroit, and the Mississippi discovered by the Jesuit, La Salle.

By the treaty of Utrecht (1713), Louis XIV. ceded to England, Hudson's Bay, New-

CANADA

M. R. Gately, Boston, Mass.



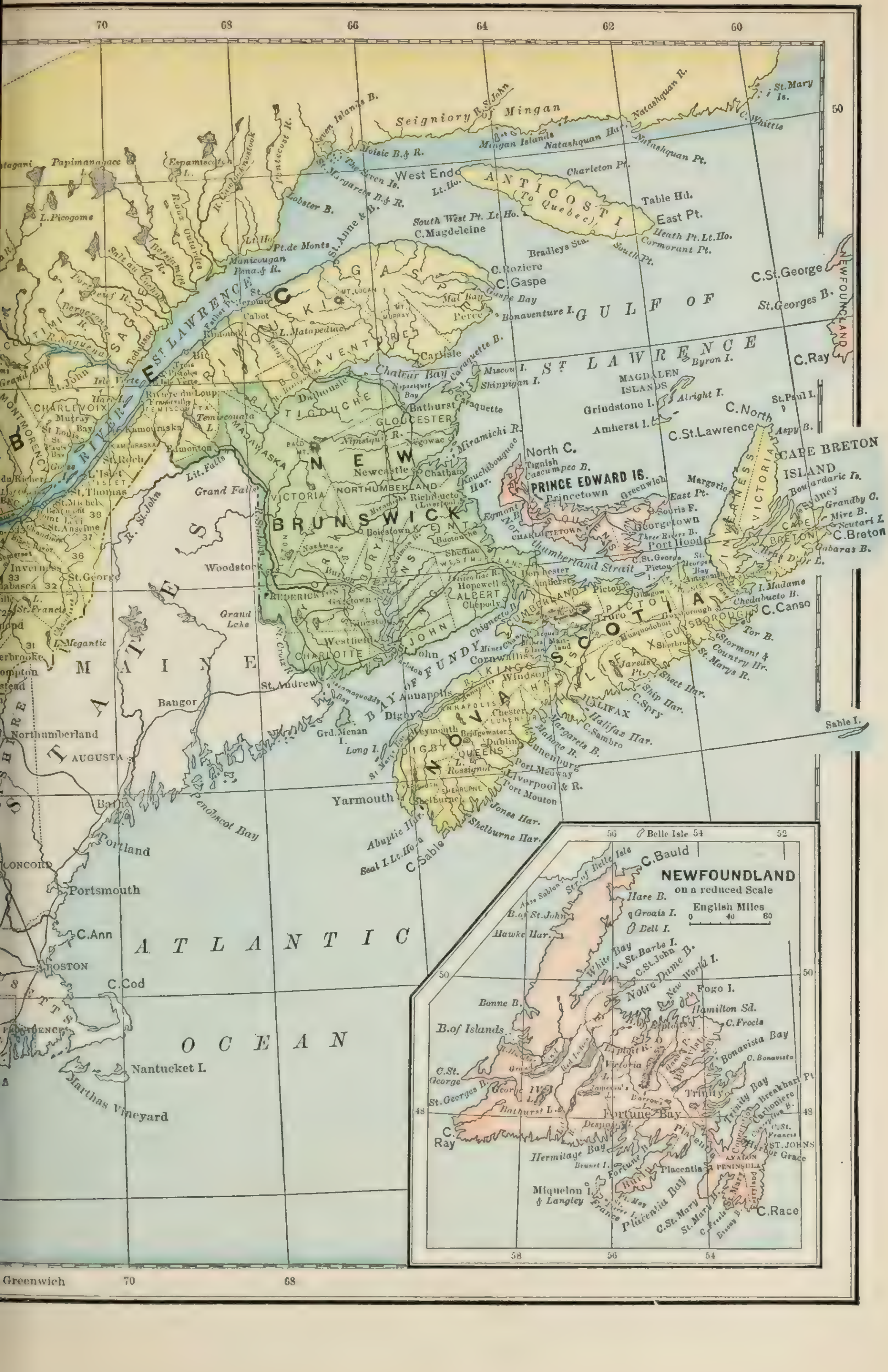
Reference to Smaller Counties in Ontario or Upper Canada.

1	Essex
2	Bothwell
3	Lambtonx
4	Middlesox
5	Elgin
6	Norfolk
7	Oxford
8	Perth
9	Waterloo
10	Brant
11	Haldimand
12	Welland
13	Monck
14	Wentworth
15	Halton
16	Peel
17	Cardwell
18	Durham
19	Northumberl'd
20	Pr. Edward
21	Lennox
22	Frontenac
23	Grenville
24	Dundas
25	Russell
26	Stormont
27	Prescott
28	Glengary

Reference to Smaller Counties in Quebec or Lower Canada.

1	Argenteuil
2	Two Mountains
3	Terrebonne
4	L'Assomption
5	Vaudreuil
6	Soulange
7	Huntingdon
8	Beauharnois
9	Chateauguay
10	Napierville
11	La Prarie
12	Chambly
13	Vercheres
14	Richelieu
15	St.Hyacinthe
16	Rouville
17	Iberville
18	St. John
19	Missisquoi
20	Brome
21	Shefford
22	Bagot
23	Drummond
24	Yamaska
25	Nicolet
26	Arthabasca
27	Wolfe
28	Richmond
29	Sherbrooke
30	Stanstead
31	Compton
32	Beauce
33	Megantic
34	Lotbiniere
35	Levi
36	Dorchester
37	Bellechasse
38	Montmagny
39	St.Maurice
40	Maskionge
41	Berthier
42	Jolliette

Fisk & Sec, N.Y.


70
68
66
64
62
60
50
48
Greenwich
GULF OF ST LAWRENCE
ATLANTIC OCEAN
ANTICOSTI (To Quebec)
West End
East Pt.
Table Hd.
Charleton Pt.
South West Pt. Lt. Ho.
Heath Pt. Lt. Ho.
Cormorant Pt.
South Pt.
Bradleys Sta.
Seigniory B. St. John of Mingan
Mingan Islands
Natashquan Har.
Natashquan Pt.
Natashquan R.
C. Whittle
St. Mary Is.
Seven Islands B.
Moisic B. & R.
The Seven Is.
St. Margarets B. & R.
Lobster B.
St. Anne & B.
Pt. de Monts
Manicougan Pena. & R.
Papimanabace L.
Espamiscoth L.
L. Picogoma
Pentecost R.
Saguenay R.
RIVER ST. LAWRENCE
RIMOUSKI
GASPE
BONAVENTURE
C. Gaspe
C. Roziere
C. Magdeleine
Gaspe Bay
Mal Bay
Perce
Bonaventure I.
Carlisle
Chaleur Bay
L. Matapedia
Cabot
Rimouski
Bic
Trois Pistoles
Isle Verte
Riviere du Loup
Fraserville
TEMISCOUATA
Temiscouata L.
Kamouraska
Edmonton
CHARLEVOIX
MONTMORENCI
Murray Bay
St. Louis
St. Roch
L'Islet
St. Thomas
St. Michel
St. Anselme
Inverness
St. George
St. Francis
L. Megantic
Sherbrooke
Compton
NEW BRUNSWICK
MADAWASKA
VICTORIA
RESTIGOUCHE
GLOUCESTER
NORTHUMBERLAND
KENT
YORK
SUNBURY
QUEENS
KINGS
WESTMORLAND
ALBERT
CHARLOTTE
ST. JOHN
Dalhousie
Bathurst
Caraquette
Shippigan I.
Miscou I.
Nepisiquit Bay
Miramichi R.
Newcastle
Chatham
Richibucto
Kouchibouguac Har.
Buctouche
Shediac
Boiestown
Fredericton
Gagetown
Kingston
Westfield
St. John
Hopewell
Chepody
Dorchester
Amherst
Grand Falls
Lt. Falls
Woodstock
St. Croix R.
St. Andrews
Grd. Menan I.
MAINE
Bangor
Grand Lake
AUGUSTA
Bath
Penobscot Bay
Portland
Portsmouth
CONCORD
C. Ann
BOSTON
C. Cod
PROVIDENCE
Nantucket I.
Marthas Vineyard
Northumberland
PRINCE EDWARD IS.
North C.
Tignish
Cascumpec B.
Princetown
Greenwich
East Pt.
Souris F.
Georgetown
Three Rivers B.
CHARLOTTETOWN
Egmont B.
Northumberland Strait
MAGDALEN ISLANDS
Grindstone I.
Amherst I.
Alright I.
Byron I.
NOVA SCOTIA
CUMBERLAND
COLCHESTER
PICTOU
ANTIGONISH
GUYSBOROUGH
HALIFAX
HANTS
KINGS
ANNAPOLIS
LUNENBURG
QUEENS
SHELBURNE
YARMOUTH
DIGBY
BAY OF FUNDY
Chignecto B.
Minas Chan.
Cornwallis
Windsor
Truro
Pictou
Glasgow
Antigonish
St. George Bay
C. St. George
Pictou I.
Musquodoboit
Sherbrooke
Jareds Pt.
Sheet Har.
Ship Har.
C. Spry
Halifax Har.
C. Sambro
St. Margarets B.
Mahone B.
Lunenburg
Chester
Bridgewater
Dublin
L. Rossignol
Port Medway
Liverpool & R.
Port Mouton
Jones Har.
Shelburne Har.
Shelburne
C. Sable
Seal I. Lt. Ho.
Abuptic Har.
Yarmouth
Weymouth
Digby
Annapolis
Long I.
St. Marys Bay
Passamaquoddy Bay
C. Canso
Chedabucto B.
Tor B.
Stormont & Country Hr.
St. Marys R.
Sable I.
CAPE BRETON ISLAND
INVERNESS
VICTORIA
CAPE BRETON
RICHMOND
C. North
C. St. Lawrence
St. Paul I.
Aspy B.
Margarie
Boulardarie Is.
Sydney
Grandby C.
Mire B.
Scutari L.
C. Breton
Gabarus B.
Bras D'Or L.
I. Madame
Port Hood
C. St. George
St. Georges B.
C. Ray
NEWFOUNDLAND
NEWFOUNDLAND
on a reduced Scale
English Miles
0 40 80
Belle Isle
56
54
52
58
C. Bauld
Str. of Belle Isle
Anse Sablon
Hare B.
Groais I.
Bell I.
B. of St. John
Hawke Har.
White Bay
St. Barbe I.
C. St. John B.
Notre Dame B.
New World I.
Fogo I.
Hamilton Sd.
C. Freels
Bonne B.
B. of Islands
Bonavista Bay
C. Bonavista
C. St. George
St. Georges B.
Grand L.
Red Indian L.
Victoria L.
Gander L.
Trinity
Trinity Bay
Breakhart Pt.
Carbonière
Conception B.
C. St. Francis
ST. JOHNS
Hr. Grace
AVALON PENINSULA
Bathurst L.
Fortune Bay
Despair Hr.
Hermitage Bay
Brunet I.
Fortune B.
Burin
Placentia
Placentia Bay
Miquelon I. & Langley
St. Pierre I. (France)
C. St. Mary
St. Marys B.
Trepassey B.
C. Race
C. Ray

foundland, and Nova Scotia; France retaining only the valleys of the St. Lawrence and the Mississippi. The vagueness of the terms of the treaty regarding boundaries brought them in conflict with the British colonies, and gave rise to a war which lasted seven years. The struggle terminated by the capture of Quebec, in 1759, by the English, under Gen. Wolfe, and of Montreal, by Gen. Amherst, in 1760. By the treaty of Paris, in 1763, the whole of Canada was ceded to England.

The English called the new territory the Province of Quebec, and had it governed by a council of seventeen, appointed by the king.

The country was thus ruled till 1791, when Canada was divided by an act of the Imperial Parliament into two provinces, Upper and Lower Canada. Each province had a governor and a legislative council, appointed by the Crown, and a popular assembly chosen by the people.

In 1812 the Indians of the northwest, instigated by British emissaries, attacked the frontier settlements. Their leader, the famous Shawnee chief, Tecumseh, was defeated at the battle of Tippecanoe. He renewed hostilities, however, six months later, at the time war was declared against England by the United States. The regular English forces and Indians combined inflicted some severe defeats on the Americans; and an invasion of Canada, undertaken by the latter in 1812, failed most signally. A second effort to conquer Canada, in 1813, also proved unsuccessful.

The Great Lakes were the scene of some sharp naval engagements. In 1813 the British squadron was defeated and destroyed on Lake Erie, by Com. Perry, and in 1814 a strong British fleet was dispersed on Lake Champlain, near Plattsburg, by Com. Macdonough.

Insurrections broke out in 1837, 1838, caused chiefly by an irresponsible administration, which denied the necessity of accord between the executive council and the legislative assembly. The insurgents, though unsuccessful, were the means of drawing the attention of the British government to the defective system in operation in Canada; and in 1841 the provinces were united under one administration and one legislature.

The Parliament sat in Montreal till 1849, when a bill was introduced to indemnify persons for losses sustained during the late rebellion. This excited the people, and they dispersed the Parliament and burned its buildings. The seat of government was removed and the Parliament met every alternate four years at Toronto and Quebec, till 1859, when Ottawa was made the capital.

The provinces of Canada, Nova Scotia, and New Brunswick formed a confederation in 1867, under the name of the Dominion of Canada. The executive power is vested in the governor-general, who is appointed by and represents the queen; the legislative power rests with the Senate and House of Commons. This Parliament regulates the interests which are common to all the provinces, though each province has its local government, and is independent of the others in the management of its domestic affairs.

The new Dominion of Canada, in 1870, desired to annex the domain of the Hudson Bay Company, and paid to the company a consideration in money and land for the transfer; but a part of the people in this territory, dissatisfied with this agreement, formed a provisional government and attempted to support it by force of arms.

The authorities sent a force against the rebels, under the command of Sir Garnet Wolseley, at whose approach they and their leader, Riel, fled. The Red River Rebellion as it was called, was thus suppressed without fighting, and the authority of the Dominion restored.

British Columbia joined the confederation in 1871, and Prince Edward's Island in 1873. Newfoundland is the only British province in North America that still maintains an independent existence.

Canada is, in regard to extent, the most important colonial possession over which Great Britain exercises dominion. It covers an area of 3,372,290 square miles, and has a population of 4,352,080.

The Canadians have a large and growing commerce, the lumber trade being the most important industry. The agricultural resources of the country are immense; wheat being the staple production.

Lord Landsdowne, the present governor-general, took the oath of office October 23, 1883. His predecessor was the Marquis of Lorne, son-in-law of the queen of England.

THE first inhabitants of Mexico of whom we have any knowledge were the Toctecs, who came in the seventh century from some undefined locality in the north, which they called Tullan, and from whence they brought to the valley of Mexico the first elements of civilization. They are said to have been skilful in mechanical arts and agriculture; but their numbers being reduced by war, pestilence, and famine, they left the country in the eleventh century, and spread themselves over Central America.

They were succeeded by the Chichemacs, another rude tribe from the northwest, about 1170, who in turn were soon followed by the Aztecs, or Mexicans, and the Acolhuans, or Tezcucons. The Aztecs, or Mexicans, arrived about 1200, but they led a migratory life till 1325, when they founded the city of Mexico.

They formed an alliance with Tezcuco and Tlucopau, by which the whole of the Mexican valley was conquered, and in the middle of the fifteenth century, under Montezuma I., the Aztec monarch, the allies extended their conquests to the borders of the Gulf of Mexico.

The able princes who succeeded Montezuma continued to extend the empire till, shortly after the discovery of America by Columbus, the dominion of the Aztecs reached across the continent from the Atlantic to the Pacific.

The government was an elective hereditary monarchy. Their laws were rather severe. Great crimes were all made capital, and the proceedings of their courts were perpetuated by means of pictorial written records.

"The code of the Aztecs," says Prescott, "evinces a profound respect for the great principles of morality, and as clear a perception of these principles as is to be found in the most cultivated nations."

The Mexicans believed in one Supreme Creator of all things, under whom stood thirteen chief and two hundred inferior divinities.

In 1519, Herman Cortes, with a Spanish expedition, landed in Mexico, Montezuma II. being king of the Mexicans. Cortes gradually subdued the entire country, which was united with other American territories in 1540, under the name of New Spain, and was governed by Spanish viceroys till 1808.

Arrival of the Passenger-Boat from Tezcuco, at the Gate of San Lazaro, Mexico.

For the three intervening centuries Mexico had few disturbances till 1810, when, during the invasion of Spain by Napoleon, the discontent that had been gaining ground against the vice-regal power broke out into open rebellion, under the leadership of a priest named Hidalgo.

This insurrection aimed at driving the Spaniards from the country. Hidalgo, however, was defeated and executed in 1811, after which the contest was continued by a priest named Morelos, who called a national congress at Chilpauzingo in 1813, which declared Mexico independent.

The contest was kept up, under different leaders, for several years with varying success till, in 1820, the Spanish authority was fully re-established. In the same year another revolution broke out in Spain, which renewed the Mexican agitation.

Independence was proclaimed in 1821, and was virtually ratified by Spain in 1822.

At the close of the war, Iturbide, a Mexican leader, succeeded in getting himself proclaimed emperor, under the title of Augustin I., but was compelled to abdicate, and was exiled. Iturbide, on returning the following year, was executed for violating the decree of banishment.

Mexico chose a federal republican form of government in 1824, which was recognized the following year by every foreign power, except Spain. Gens. Vittoria and Bravo were respectively elected president and vice-president for four years.

The new republic was constantly disturbed by outbreaks of civil war, under the leadership of the Escosses, or aristocratic faction, and the Zorkinos, or democrats.

Vittoria was succeeded by Gen. Pedraza, whose government was overthrown by Guerrero, who assumed the presidency in 1829. Guerrero was deposed by his vice-president, Bustamante; he in turn was deposed by Santa Anna, in 1833.

In 1835 the constitution was changed, so that, from a confederation of states, the country became a consolidated republic. Texas seceded and proclaimed its independence. Santa Anna, who commanded the Mexican troops, marched against the Texans, but was defeated and made prisoner at San Jacinto, in 1836. He was released a year later, and held the presidency twice from that date till 1844.

Canalizo, who was president in the latter part of 1844, was deposed by Gen. Herrera, and during the administration of the latter Mexico became involved in a quarrel with the United States, on account of a dispute respecting the boundary of Texas, which had been annexed to the United States in 1845.

During the conflict which ensued, Santa Anna, who had been exiled, returned, deposed Herrera, and took command of the Mexican army. The Mexicans were defeated at Palo Alto and Monterey in 1846, and at Buena Vista in 1847. The Americans, under Gen. Scott, also captured Vera Cruz in the same year, and won the battles of Cerro Gordo, Churubusco, and Chapultepec. Scott entered the city of Mexico in September, 1847, and held it till the close of the war.

New Mexico was conquered by Gen. Stephen Kearney in 1846; and in 1847 California was annexed to the United States, with Gen. Kearney as governor.

By the treaty of Guadalupe Hidalgo, signed February, 1848, Mexico ceded California and New Mexico to the United States, and yielded the boundary of the Rio Grande, in consideration of which the United States agreed to pay $15,000,000, and $3,750,000 additional for debts due by Mexico to American citizens.

The close of the war was followed by a series of revolutions, during which there were frequent changes in the presidency. Benito Juarez, who was the leader of the popular party, established his government in the city of Mexico in 1861. Spain, France, and England made demands on him for indemnity for losses sustained by their citizens in Mexico, which, not being satisfactorily adjusted, the forces of the three powers occupied Vera Cruz in 1862. Negotiations were entered into, the result of which was satisfactory to England and Spain; but France, being besought by those opposed to the administration of Juarez to establish a monarchy in the country, was not satisfied, and accordingly declared war against Mexico in April, 1862.

The French army entered the city of Mexico, June 10, 1863, a regency was established, and the crown offered to, and accepted by, the Archduke Maximilian, brother of the Emperor Francis Joseph of Austria.

Maximilian entered the city of Mexico, June 12, 1864; but the feeling of the republicans was so strong against him, that he was kept on his throne only by the presence of French troops. The United States protested against the occupation of Mexico by a French army, and the troops were withdrawn in March, 1867.

Juarez gave battle at Queretaro, and the imperial army was defeated. Maximilian was captured, tried by court martial, and was shot June 19, 1867.

Juarez was elected to the presidency, which he held till his death, in 1872, when he was succeeded by Lerdo de Tejada, who was overthrown, in 1876, by Gen. Porfirio Diaz. The present president is Gen. Gonzalez

The area of Mexico is about 750,000 square miles, and its population 10,000,000. The country is one of the richest in natural resources on the American continent. The produce of its gold mines surpassed that of any other country in the world until the discovery of the metal in Australia; and silver mines are abundant. Its tropical position and sudden differences of elevation give it the vegetation of different climates. The principal cities are connected by railroad, and the mines are worked by foreign, mostly American, capital.

WEST INDIA ISLANDS

WHEN Columbus discovered the West India Islands, in 1492, the southern islands were inhabited by the fierce and warlike Caribs; and the northern by the Arrowauks, who were mild and gentle. The latter had a monarchical form of government, the kings being called caciques, and their power being hereditary. They believed in the existence of a Deity and a future state of rewards and punishments.

At present the great mass of the population is of African origin, the remainder is composed of different nationalities.

The British own seventeen islands and groups of islands, the largest of which is Jamaica.

The Spaniards own two islands, Cuba and Porto Rico, Cuba being the larger.

The French own six, the largest of which is Guadeloupe.

The Dutch own four, of which the largest is Curaçoa.

The Danes own three, the largest being Santa Cruz; and the Swedes own one, St. Bartholomew.

Hayti, or San Domingo, is independent.

CUBA.

The first of the West India Islands in size and commercial importance is Cuba. It was originally called Juano, in honor of Prince John, son of Ferdinand and Isabella. On the death of Ferdinand it was called Fernandina. It was afterwards called Santiago, from the patron saint of Spain, and still later Ave Maria, in honor of the Virgin.

A town was begun in 1515, called San Christoval de la Havana. The name was transferred, in 1519, to the present capital, the first-named place being now called Batabano. Havana was attacked and destroyed by the French in 1538 and 1554.

The English, under Lord Albemarle, captured Havana in 1762, and Cuba was restored to the Spaniards by the treaty of Paris in the following year.

The most brilliant epoch in Cuban history is represented as the administration of Las Casas, who arrived as captain-general in 1790. He introduced the culture of indigo, promoted public works, and extended the commercial importance of the island.

Cuba has been ruled by a succession of governor captain-generals from Spain, who have absolute authority. The arbitrary manner in which the Cubans have been ruled by some of their governors, and the heavy taxation they are subjected to, have resulted in a deadly hatred between the native Cubans and the officials sent from Spain. This has led to frequent risings, the most important of which were the conspiracies of the "Black Eagle," in 1829; that of Narcise Lopez, in 1848–51; and the revolution of 1868, which continued for several years, and during which the Cubans made a declaration of independence at Manzanillo, Oct. 10, 1868. The insurrection was finally suppressed, though the Spaniards were harassed for years by guerilla warfare, and great damage done to property by the war, which, with increased taxation, leaves Cuba at present in a not very prosperous condition.

The people of the United States have always sympathized with the Cubans, though it has not amounted to actual interference. In 1848, President Polk, through the American minister at Madrid, unsuccessfully proposed the transfer of the island to the United States for $1,000,000.

CENTRAL & SOUTH AMERICA

TWELVE years after Columbus discovered the main-land, the Spaniards, under Vasco Nuñez de Balboa, settled on the isthmus. Learning from the Indians that there was a great sea to the southward, on the coasts of which lived a people who ate and drank from vessels of gold, he crossed the isthmus and discovered the Pacific Ocean, so called from its supposed freedom from storms.

Central America, considered geographically, includes the whole strip of territory from the Isthmus of Tehuantepec to the Isthmus of Darien; but politically it includes only the five independent republics of Costa Rica, Nicaragua, Honduras, San Salvador, and Guatemala.

The Isthmus of Panama is assigned to South America as part of New Granada, and the Isthmus of Tehuantepec and the Peninsula of Yucatan are incorporated with North America as part of Mexico.

Central America is about eight hundred miles in length, and varies in breadth from thirty to three hundred miles.

The five republics formed a federal republic from 1832 to 1839, and have frequently endeavored since then to effect a restoration of their union.

Their area aggregates about 175,000 square miles, and their respective populations are as follows: —

Guatemala, 1,200,000; Honduras, 400,000; San Salvador, 600,000; Nicaragua, 250,000; Costa Rica, 167,000.

PERU.

Francisco Pizarro, one of the followers of Balboa, discovered Peru in 1531; and he was followed soon after by Amalgro, his second officer. Gold appeared to be everywhere. In the temples of worship and the palaces of the princes every vessel for ornament or use was made of the precious metal.

Pizarro founded a city in the valley of Taugarala, to which he gave the name of San Miguel, in honor of the saint of that name. He marched to the residence of the Inca, or king Atabalipa, and having invited him to a friendly interview, he treacherously seized and made him prisoner. The Peruvian monarch, believing that gold would procure his release, gave to Pizarro a quantity of the metal equal in value to $7,500,000, notwithstanding which the Inca was burned to death as a usurper and idolater.

Pizarro then marched southward, and easily possessed himself of the city of Cusco, the Peruvian capital, after which he founded the city of Lima, in 1535.

On account of the cruelty of the Spaniards, the Peruvians rose in rebellion, took and burned Cusco, and such Spaniards as fell into their hands were put to death.

Not long after, the Spanish chiefs, Pizarro and Almagro, quarrelled with each other, and a civil war ensued. Almagro was taken prisoner, condemned and executed, and Pizarro soon after was assassinated. The natives took advantage of these contentions, and rose against the Spaniards; they were subdued, however, in 1548, and Peru became a province of Spain.

Peru secured its independence in 1826, mainly through the exertions of Gen. San Martin. The country, like most of the South American republics, has been troubled greatly by civil war.

In 1879 war was declared against Chili, by Peru and Bolivia, in which Chili was victorious. Bolivia made terms of peace, which Peru seemed unwilling or unable to do; and at present Peru is in a deplorable condition, with the better portion of its territory held by the Chilians, and the rest under the sway of lawless bands. Its area is about 500,000 square miles, and population about 3,050,000.

VENEZUELA.

The whole coast of Venezuela, or Little Venice, was explored by Amerigo Vespucci in 1499. It was conquered and colonized by the Spaniards in the early part of the sixteenth, and remainded under their control until the beginning of the present, century.

Gen. Francis Miranda, a native of Caraccas, who served with distinction in the armies of republican France, made an unsuccessful effort to deliver Venezuela from the Spanish yoke. His lieutenant, Don Simon Bolivar, led a revolt which resulted in the independence of the country in 1819, and established the republic of Colombia.

Venezuela retired from the confederation in 1829, and became an independent state. From 1846 to 1869 a series of revolutions occurred, the final result of which was the appointment of Guzman Blanco as provisional president in 1870. He was elected by the people in 1873, and under his rule the country has prospered.

COLOMBIA.

The republic of Colombia, which consisted of Venezuela, New Granada, and Eucador, was broken up, in 1830, by the withdrawal of the states and the formation of separate independent republics, New Granada retaining the name of Colombia. Bolivar, who was the first president of Colombia, was a poor statesman, and when he afterwards became dictator of New Granada the people revolted from his despotic rule. After his death, in 1830, the country was divided by factions, and so continued till Guzman Blanco, a liberal president, defeated his opponents. He proved a wise ruler, and under his administration the country prospered. Gen. Julian Turgillo is the present president. The country has a population of about 3,000,000, with an area of 504,773 square miles.

ECUADOR.

This country was first known as the kingdom of Quito, and the original inhabitants were Indians. It was made part of the Peruvian Empire, and with it fell into the hands of the Spaniards, who ruled it by means of viceroys from 1553 to 1822.

The demands of the Spanish government became so exacting, that the people revolted in 1809. After a number of unsuccessful outbreaks, they finally established their independence in 1822, and became part of the republic of Colombia. When the Colombian confederation was dissolved in 1831, Ecuador became an independent republic. The capital city, Quito, was destroyed by an earthquake in 1858.

The country was the scene of intestine feuds for a number of years, till, in 1869, Garcia Moreno overthrew the government, and made himself president. He was assassinated in 1875, and Dr. Antonio Borrero was chosen president.

Ecuador has an area of 248,000 square miles, and a population of about 866,000. The Galapazos Islands, an uninhabited group in the Pacific, with an area of 2,951 square miles, are dependent on Ecuador.

CHILI.

For several years after throwing off the Spanish yoke, Chili was governed despotically. A new constitution was adopted in 1833, since which the prosperity of the country has developed, and under which there has been no serious conflict of parties as in the neighboring states. By the administration of President Moutt, in 1856, a new and well-arranged code of laws was secured; a chamber of commerce, and a bank of discount and deposit at Valparaiso, were established; and treaties with the United States, France, and Great Britain were entered into.

In the trade between Chili and Bolivia certain duties were imposed by Chili on products imported from the latter, which being disapproved of by Peru gave rise to a war between the two countries which has been decidedly in favor of Chili. A portion of Peruvian territory was seized, and a large money indemnity demanded. The negotiations in progress for two years have not yet (1882) ended in a permanent peace, and a portion of Peru is at present occupied by Chilian troops.

The population of Chili is increasing rapidly, and immigration from Europe, especially from Germany, has been successfully promoted. The government meets its public obligations punctually, and its credit is good. The population is 2,074,000, and the area 123,000 square miles.

PARAGUAY.

Paraguay obtained its independence in 1811. It was at first governed by a junta, but in 1813 the executive power was confided to two consuls, one of whom, Dr. Francia, made himself dictator for life. He was a vigorous, though sometimes cruel ruler; but on the whole the country prospered fairly under him. After his death in 1840, the consular system was revived and continued in operation till 1844, when Carlos Lopez was made dictator, a position which he held for eighteen years. His rule was almost as despotic as that of Dr. Francia; but he allowed foreigners, who had been forbidden by the first dictator to enter or leave the country, to come and go at will, and was in other respects a more liberal ruler

Lopez died in 1862, and was succeeded by his son, Marshal Lopez. He was very ambitious to extend his dominions, and attacked Brazil in 1864. The Argentine Republic and Uruguay made common cause with Brazil. Lopez was defeated and killed at Aquidaban in 1870, and the greater portion of Northern Paraguay was ceded to Brazil. Since then several revolutions have occurred, which were suppressed with the assistance of Brazil; and Paraguay, though nominally independent, is still under Brazilian protection.

ARGENTINE REPUBLIC.

In 1821 a republic was formed on the Platte River, with Buenos Ayres as the capital. It continued to exist for a number of years, with frequent changes in the government, till the formation of the Argentine Republic by the confederation of the provinces of Buenos Ayres,—Corrientes, Entre Rios, and Santa Fé. Gen. Rosas, who was chosen president in 1833, frequently endeavored to force Paraguay and Uruguay to join the confederation, which finally involved him in a quarrel with Brazil, in which he was defeated, and fled to England in 1852.

From that time to the present the Argentine territory has suffered greatly from the conflict of factions. Its population, which is steadily on the increase, is about 2,000,000, and its area 562,788 square miles.

BRAZIL.

Brazil was discovered in 1500 by Pedro Alvarez Cabral, a Portuguese navigator, and for three hundred years it was held by Portugal as a colony. During the seventeenth century the country was frequently attacked by the Dutch, and several important settlements in it captured; but they were finally expelled by the Portuguese in 1654.

The discovery of gold and diamonds, about the beginning of the eighteenth century, added materially to the wealth of the country, though agriculture has always been the staple industry. The cultivation of coffee was introduced in 1750, and has since become one of its leading articles of export.

In 1807, Napoleon took Portugal, and declared that "the house of Braganza" had ceased to reign. The royal family emigrated to Brazil, and raised it to the dignity of a kingdom on the overthrow of Napoleon, in 1815.

The king, Joam VI., left for Portugal in 1821, and appointed his son, Prince Pedro, regent of Brazil. The following year a constitutional government was established, and Pedro proclaimed Emperor.

Joam VI. died in 1826, and Pedro succeeded to the crown of Portugal, which he resigned in favor of his infant daughter, Doña Maria da Gloria.

A dispute arose in 1831 between Pedro and his chamber of deputies, which terminated by the abdication of the king in favor of his son, Pedro II., the present Emperor, then but five years old, and now the oldest reigning monarch in the world.

Under his rule the slave traffic was abolished, and laws enacted for the gradual extinction of slavery, and the country has advanced in civilization and prosperity. The Emperor and Empress visited the United States in 1876, and were present at the opening of the Centennial Exhibition. They afterwards visited Europe, and returned to Brazil in 1877.

Brazil, which is the only empire on the American continent, has an area of about 3,200,000 square miles. It has a seacoast line of 4,000 miles, and a population of about 11,000,000. The present monarch endeavored to turn the tide of German emigration to Brazil, and has succeeded in establishing an important colony of them on the Rio Grande do Sul. Laws were passed in 1850 offering liberal inducements, to colonists particularly, as to the easy purchase of lands.

The river Amazon, the largest in South America, with its tributaries in Brazil, drains an area of 800,000 square miles.

BOLIVIA.

The country passed under the dominion of Spain after the Spanish conquest of Peru, and became a part of the viceroyalty of the latter, under the name of Upper Peru. It formed a portion of the viceroyalty of Buenos Ayres in 1767, and was made an independent republic by Gen. Simon Bolivar in 1825, and named, in honor of him, Bolivia. Gen. Sucre was chosen president for life, but he accepted the position for only two years, during which repeated insurrections occurred, and in 1828 his troops were driven from La Paz, and a congress at Chuquisaca chose Marshal Santa Cruz president. In a war against Peru and Chili, after three years' fighting, Santa Cruz was defeated and exiled, and Gen. Velasco chosen provisional chief.

The Bolivians revolted against the new government, and installed Gen. Ballivan in supreme power. The country was the scene of a revolution almost every year till 1866, when Maria Melgarejo, after subduing two revolutions in 1865 and 1866, declared a political amnesty, gave the country a revised constitution, and became its dictator.

President Morales was elected in 1871, since which time a civil government has superseded the military system, and efforts have been made to restore the credit of the country and free it from its heavy foreign debt.

Bolivia has hitherto been celebrated for the richness of its silver mines in the mountains of Potosi. It is estimated that during two hundred and twenty-five years, or up to A. D. 1800, not less than $1,647,901,018 have been obtained from these mountains alone.

The area of the country is 536,000 square miles, and the population about 2,000,000.

PATAGONIA.

Patagonia forms the southern part of the continent of South America, and embraces an area of about 350,000 square miles, and a population estimated at 25,000. It is composed mostly of desert land, without water, except the western side, which is occupied by the Andes. The natives were at one time fabled to be eight or ten feet high. They are found to exceed the average height, though few are much above six feet.

In the west there are large forests, and the only part of Eastern Patagonia where there is any vegetation is a small portion of the north. The country is, on the whole, uninhabitable to Europeans.

The government of Chili claims the western part of Patagonia, and the Argentine Republic the eastern side. The Chilians have lately formed a few small settlements in the country, though most of the efforts in this direction have proved failures.

URUGUAY.

A band of Jesuit missionaries made the first European settlement in this country in 1622. Several colonies were afterwards planted by the Portuguese, who had previously settled in Brazil, which resulted in a war with the Spaniards, by which the Portuguese were expelled in 1724.

The Spaniards ruled the country till 1811, when a war for independence was declared, and a republic established in 1814. The country was invaded by the Portuguese and annexed to Brazil in 1821, but its independence was recognized by the latter in 1828.

After the adoption of a constitution in 1830, a civil war ensued, which continued for several years, and which was terminated in 1852 by the intervention of England and France.

Since then there have been several minor insurrections and frequent changes in the presidency, and in 1876 Señor Latorre declared himself dictator.

It has an area of 63,300 square miles, and a population of about 450,000.

GUIANA.

This territory is situated between the mouths of the rivers Orinoco and Amazon, and is divided into British, French, and Dutch Guiana.

British Guiana covers 100,000 square miles and consists of three counties, — Demerara, Essequibo, and Berbice. They were first settled by the Dutch, captured by the British in 1796, given up to the Batavian Republic in 1802, and ceded to Great Britain in 1814.

Its staple products are sugar, rum, coffee, and cotton. The capital is Georgetown.

Cayenne, or French Guiana, was formed by a colony from Caen, in Normandy, in 1630. From that time down to 1814 it passed alternately into the hands of the Dutch, British, Portuguese, and French. It has an area of 27,000 square miles, and a population of about 20,000.

French Guiana had long been used as a penal settlement for political offenders. Successful efforts have been made to cultivate the clove, pepper, and nutmeg of Asia.

Dutch Guiana originally comprehended Surinam, Berbice, Demerara, and Essequibo, but in 1814 the last three were transferred to Britain. Surinam has an area of 36,000 square miles, and a population of about 70,000, most of whom are negroes. Paramaribo, the capital, has a population of 20,000.

AUSTRALIA

THIS country was discovered in 1606 by Torres, who, with a ship commissioned by the Spanish government of Peru, passed through the strait which bears his name. In this and succeeding years the Dutch also made several explorations of the coast, and in 1642 Tasman reached the island which now bears his name, but which he called Van Diemen's Land, after the Dutch governor of Batavia.

The English made their first appearance on the Australian coast in 1688; but it was not till the celebrated voyages of Capt. Cook, from 1769 to 1777, that the most important discoveries were made, and the country opened to European enterprise and settlement. Thirty years after Cook's time, Bass and Flinders continued the work of maritime discovery, and to their efforts is mainly due the correct determination of the shape of Tasmania and the neighboring continent.

The original inhabitants of Australia are called Papuans, and are supposed to have drifted in canoes from the island of Timor. They are somewhat similar in appearance to the African negro, the color of the skin being lighter, though of a dusky hue. It is computed that about 80,000 of them remain on the continent.

NEW SOUTH WALES.

New South Wales is the oldest of the Australian provinces. Eighteen years after Cook explored the east coast, Port Jackson was made a penal station for English convicts, and continued as such till 1839, when transportation was virtually suspended. From 1821, however, the colony has made a fair start in free industrial progress.

When the penal system was abolished, the social conditions of this and the other Australian provinces became somewhat equalized. The colony was ruled by British governors (with their residence at Sydney, the capital) from 1788 till 1831. They ruled with despotic power, but in the latter year the colony succeeded in obtaining the advantages of a local representative institution. Since which time it has prospered and proved attractive to emigrants with capital.

VICTORIA.

South of New South Wales lies Australia Felix (first explored by Mitchell in 1834–36), now known as Victoria. Melbourne, its capital, which began with a few huts on the banks of the Yarra-Yarra in 1835, rapidly increased in population and commercial importance, and is now the most flourishing city on the Australian continent.

BOURKE STREET, MELBOURNE, AUSTRALIA.

Gold was discovered in February, 1851, twenty miles north of Bathurst, by Mr. E. Hargraves, a gold miner from California. The intelligence was made known in April or May; and then began a rush of thousands for the "Diggins," — men left their former employments to search for the precious ore. In August of the same year it was found at Anderson's Creek, near Melbourne; a few weeks later the great Ballarat gold field, eighty miles west of the city, was opened; and after that Bendigo, now called Sandhurst, to the north. Throughout every British colony in Australia every ordinary industry was for the time abandoned, the majority of the inhabitants flocking to Victoria and New South Wales. Adventurers and immigrants from Europe, America, and even from China, poured into Melbourne, so that the population of the colony doubled in the first year of the gold fever.

Victoria was formed into a separate province in 1851, with Mr. Latrobe as governor. Since that time it has increased more rapidly in wealth and population than any of the sister colonies, though South Australia, with its capital Adelaide, has nearly equalled it in the same time.

QUEENSLAND, which forms the northern part of Eastern Australia, separated from New South Wales in 1859, and in the first six years of its independent existence it quadrupled its population and trebled its trade. The principal city and seat of government is Brisbane.

TASMANIA, or Van Diemen's Land, had been occupied as early as 1803. It was an auxiliary penal station, under New South Wales, till 1825, when it became a separate province. The transportation of convicts, however, was continued by the British government till 1853.

It covers an area of 26,215 square miles, and has a population of 109,947. The principal city is Hobart Town.

SOUTH AUSTRALIA. — The first settlement in this province was made by the English in 1836 at Adelaide, the present capital, so called in honor of the wife of William IV. It has long been recognized as a colony of much promise, and though its population decreased materially in 1851, owing to the discovery of gold in Victoria, it has since regained its onward progress. The province has an area of 900,000 square miles, and a population of 248,795.

WESTERN AUSTRALIA. — An English settlement on the Swan River, established in 1827 and 1829, together with a small convict station at St. George's Sound, formed Western Australia.

In 1850 the colonists requested the English government to make their province a penal settlement, which was done. The presence of convict labor affected to some extent the sister provinces, and the transportation of criminals was stopped in 1868. Since then the province has been quite prosperous.

The principal city and seat of government is Perth, and the population is 28,166.

The great staple production of Australia is wool. New South Wales has abundance of copper, iron, and coal; also silver, lead, and tin, and is fast becoming a seat of manufactures. Queensland has also much mineral wealth, and excels the neighboring provinces in the production of tin; while South Australia yields not only a fair proportion of wool and copper, but is likewise the great wheat-growing province of the continent.

The Australian continent covers an area of about 3,000,000 square miles, and has a population of over 2,000,000.

NEW ZEALAND.

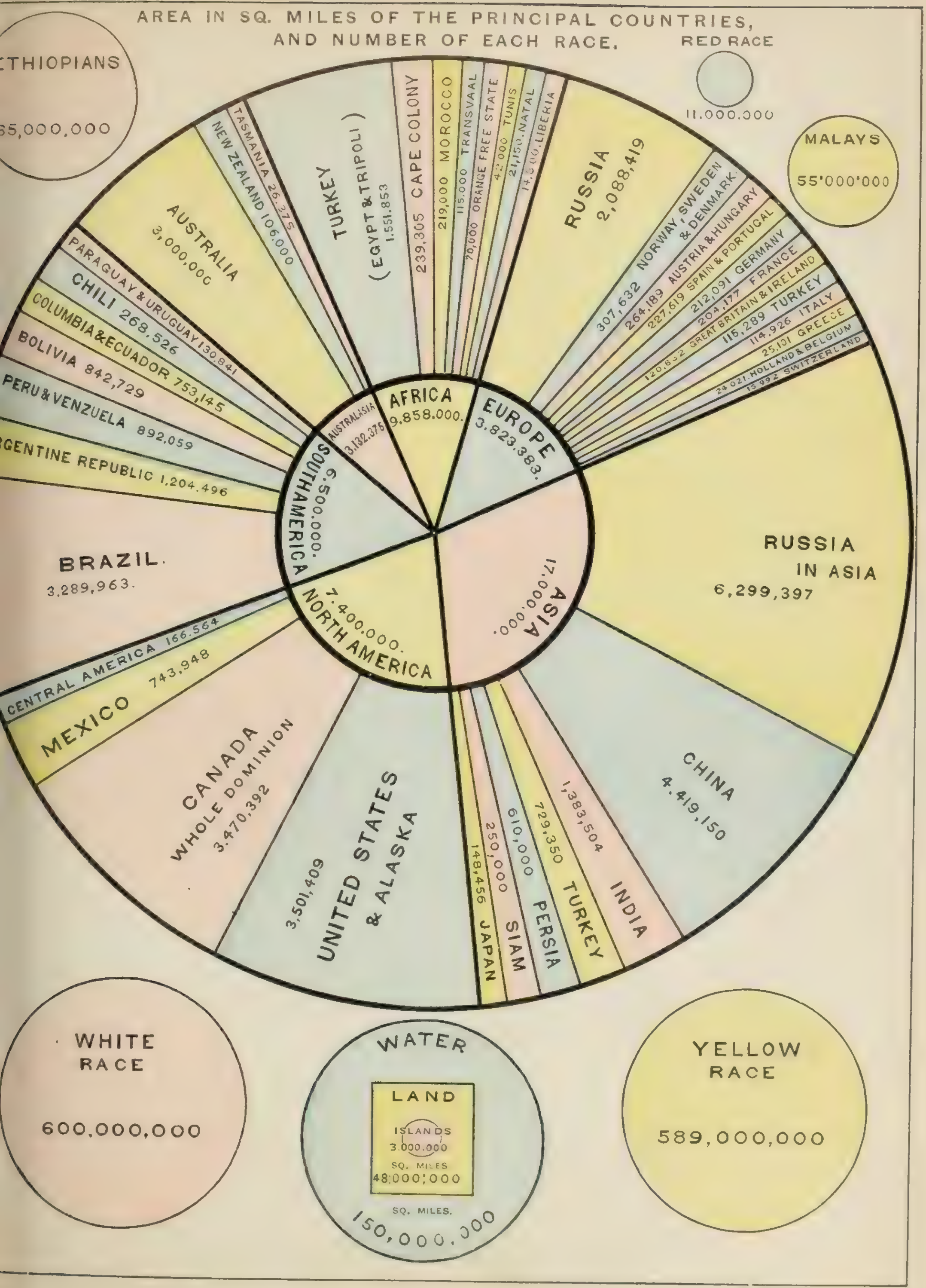
New Zealand consists of three islands in the South Pacific Ocean, lying about one thousand two hundred miles to the east of the Australian continent. It was discovered by Tasman in 1642, who, however, made no attempt to colonize it. Capt. Cook visited it in 1769, but the first effort to settle it was made by the English in 1814. The capital city, Auckland, was founded in 1840, and Capt. Hobson was appointed by the English government the governor in the same year.

During the succeeding years a desultory warfare was kept up with the native Maoris, in which contests they were several times defeated. Matters were satisfactorily adjusted in 1879. Since then the English have had peaceable and undisputed possession of the country.

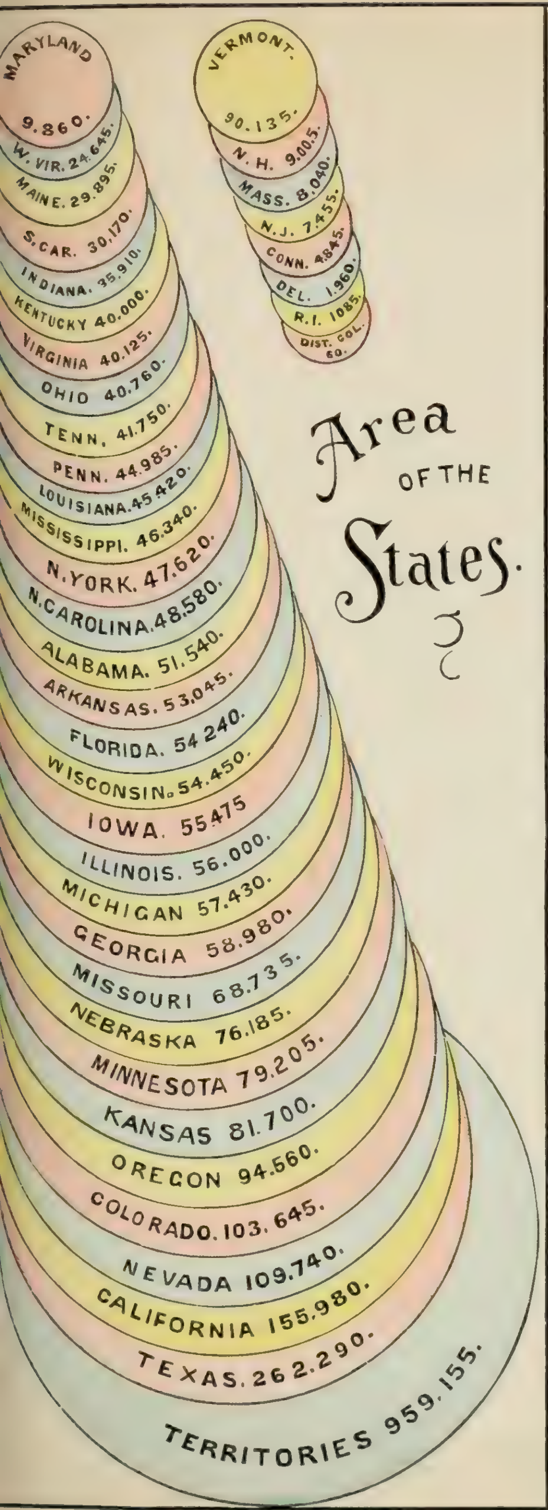
The province of New Zealand covers about 106,000 square miles, and has a population of 476,642. The seat of government was transferred from Auckland to Wellington in 1865. The principal industries are agriculture and sheep raising, and the resources of the province are being rapidly developed.

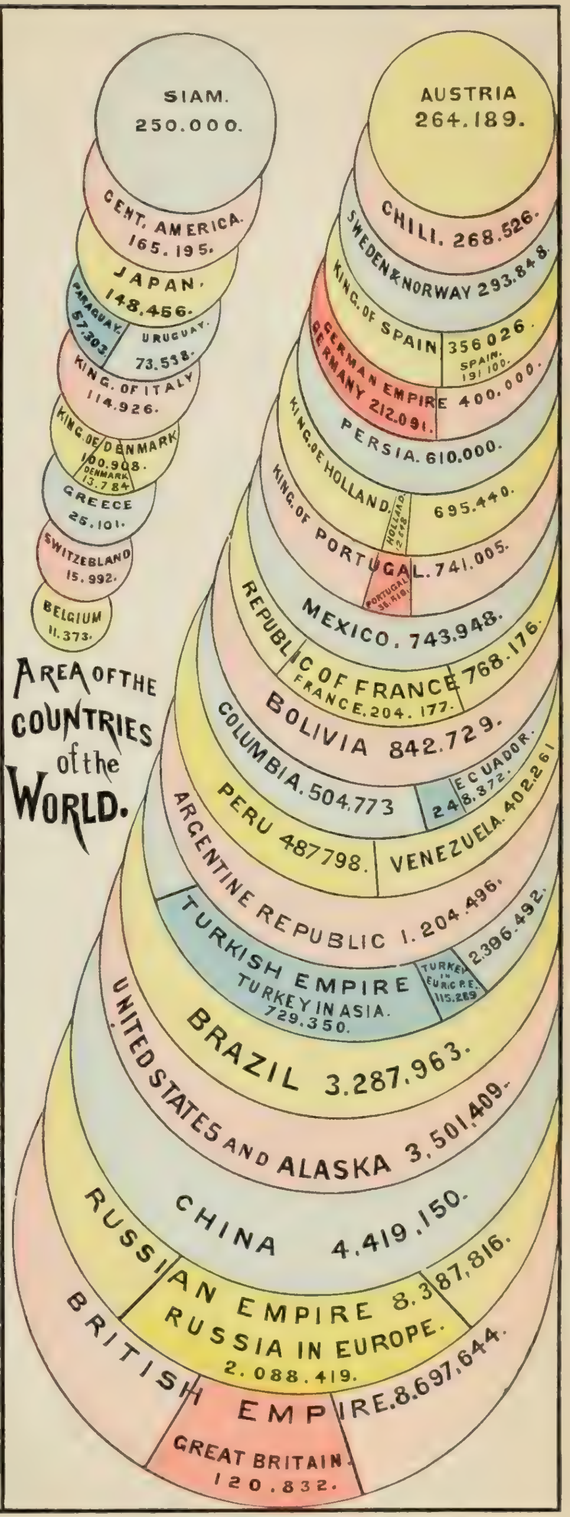
Table showing the number of people belonging to each of the seven great creeds of the world, the number in each division of the earth, and in each nation of Europe.

	Buddhists, Shintas, and followers of Confucius.	Christians.	Aboriginal Tribes practising Fetichism, and other Pagans.	Brahminical Hindoos.	Mohammedans.	Jews.	Parsees.
WOLRD'S TOTAL.	482,600,000	413,480,844	227,001,000	150,000,000	122,795,723	8,230,940	1,000,000
Russia in Europe	....	72,846,347	26,000	....	2,600,000	3,000,000	....
Germany	....	44,718,254	....	....	100	520,575	....
Austria-Hungary	....	37,738,718	....	....	300	1,238,426	....
France	....	37,356,354	....	....	3,100	49,439	....
Great Britain and Ireland	....	35,195,312	....	....	....	51,250	....
Italy	....	28,405,811	....	....	....	31,280	....
Spain	....	16,625,860	....	....	....	....	....
Belgium	....	5,535,154	....	....	....	1,500	....
Sweden and Norway	....	5,493,065	....	....	....	1,836	....
Roumania	....	5,290,000	....	....	....	....	....
Portugal	....	4,348,551	....	....	....	....	....
Turkey in Europe	....	2,175,000	....	....	2,100,000	....	....
Holland	....	3,922,730	....	....	....	89,963	....
Switzerland	....	2,838,729	....	....	....	7,373	....
Bulgaria and Roumalia	....	2,610,000	....	....	....	....	....
Denmark	....	1,969,454	....	....	....	....	....
Greece	....	1,969,206	....	....	917	2,652	....
Servia	....	1,616,856	....	....	81,306	2,049	....
Montenegro	....	250,000	....	....	....	....	....
Asia and near islands	482,600,000	6,789,000	98,202,000	150,000,000	52,000,000	2,000,000	1,000,000
Africa and near islands	....	3,919,000	121,601,000	....	66,000,000	1,000,000	....
America and near islands	....	90,433,443	4,241,000	....	....	231,697	....
Australia and Polynesia	....	1,434,000	2,931,000	....	....	2,900	....

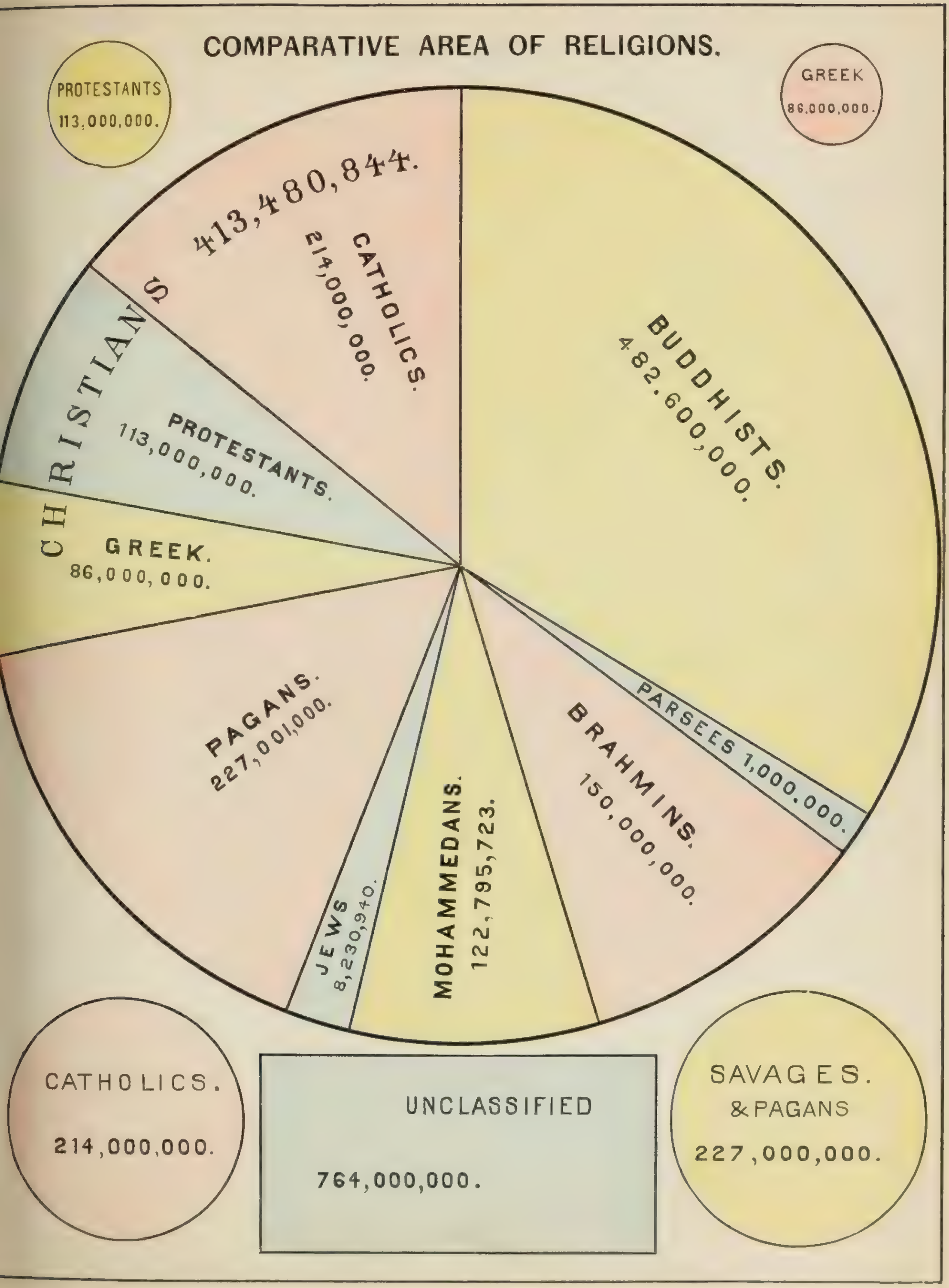


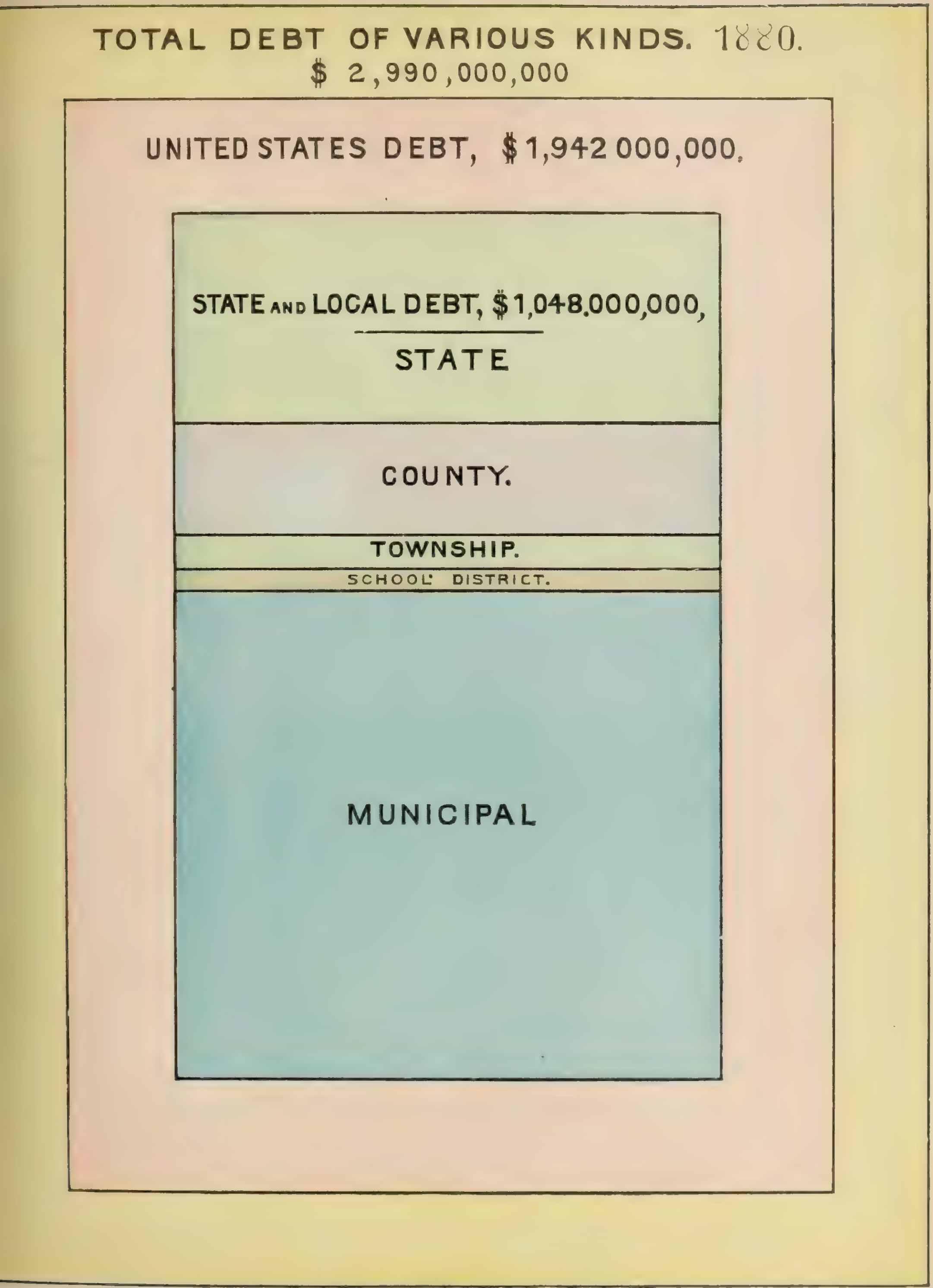
AREA IN SQ. MILES OF THE PRINCIPAL COUNTRIES, AND NUMBER OF EACH RACE.

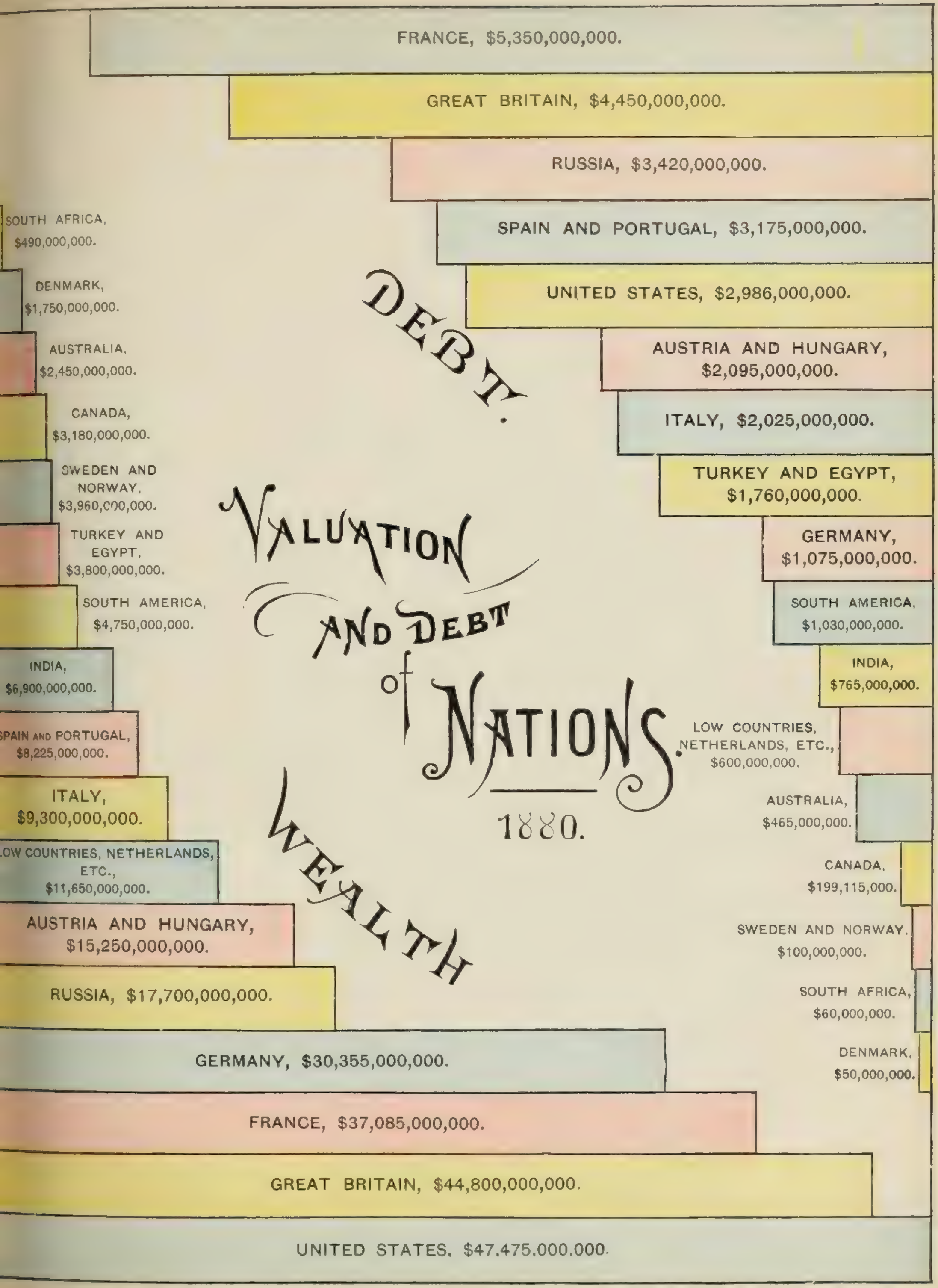

Area of the States.

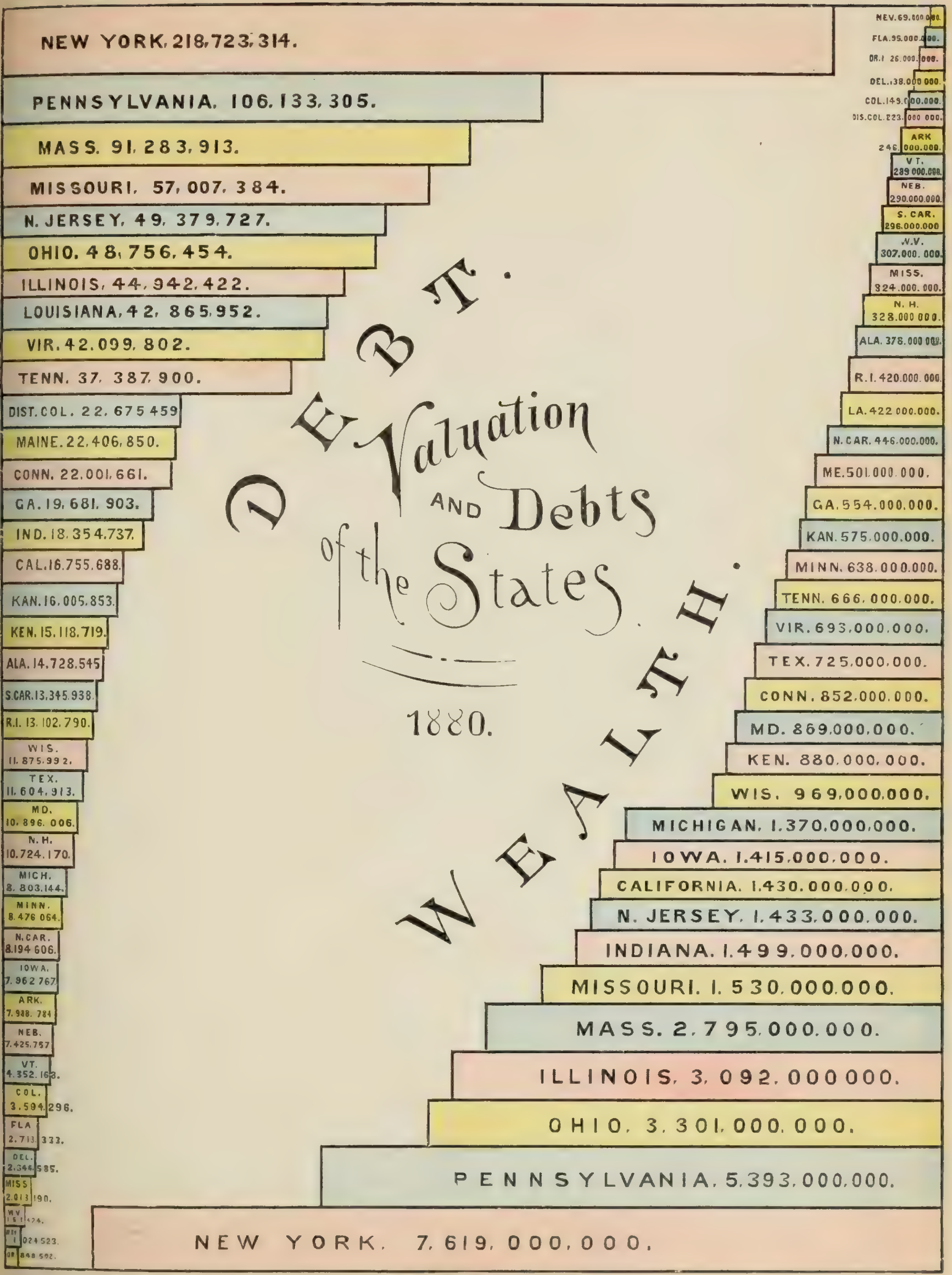

Area of the Countries of the World.

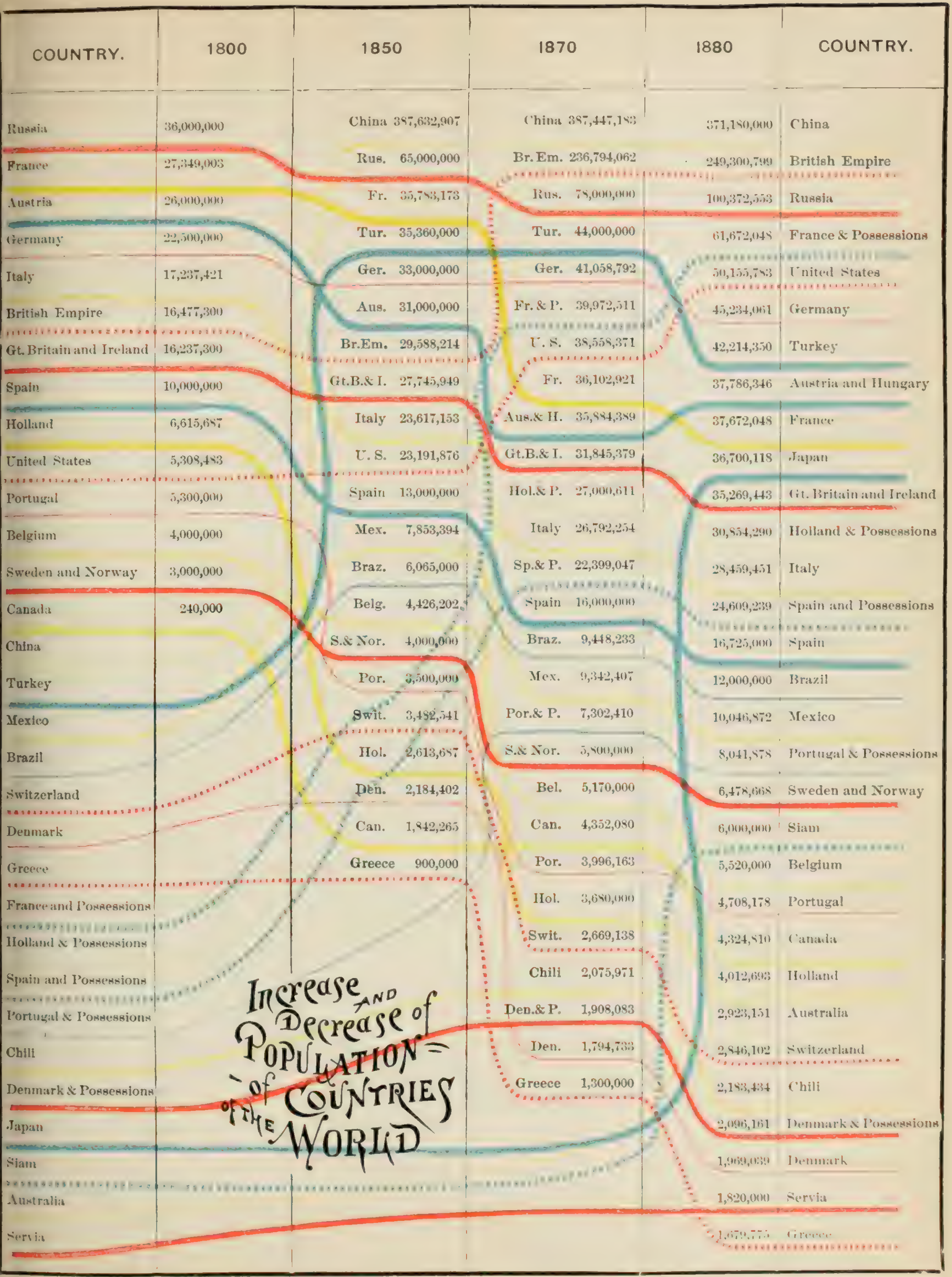
COMPARATIVE AREA OF RELIGIONS.

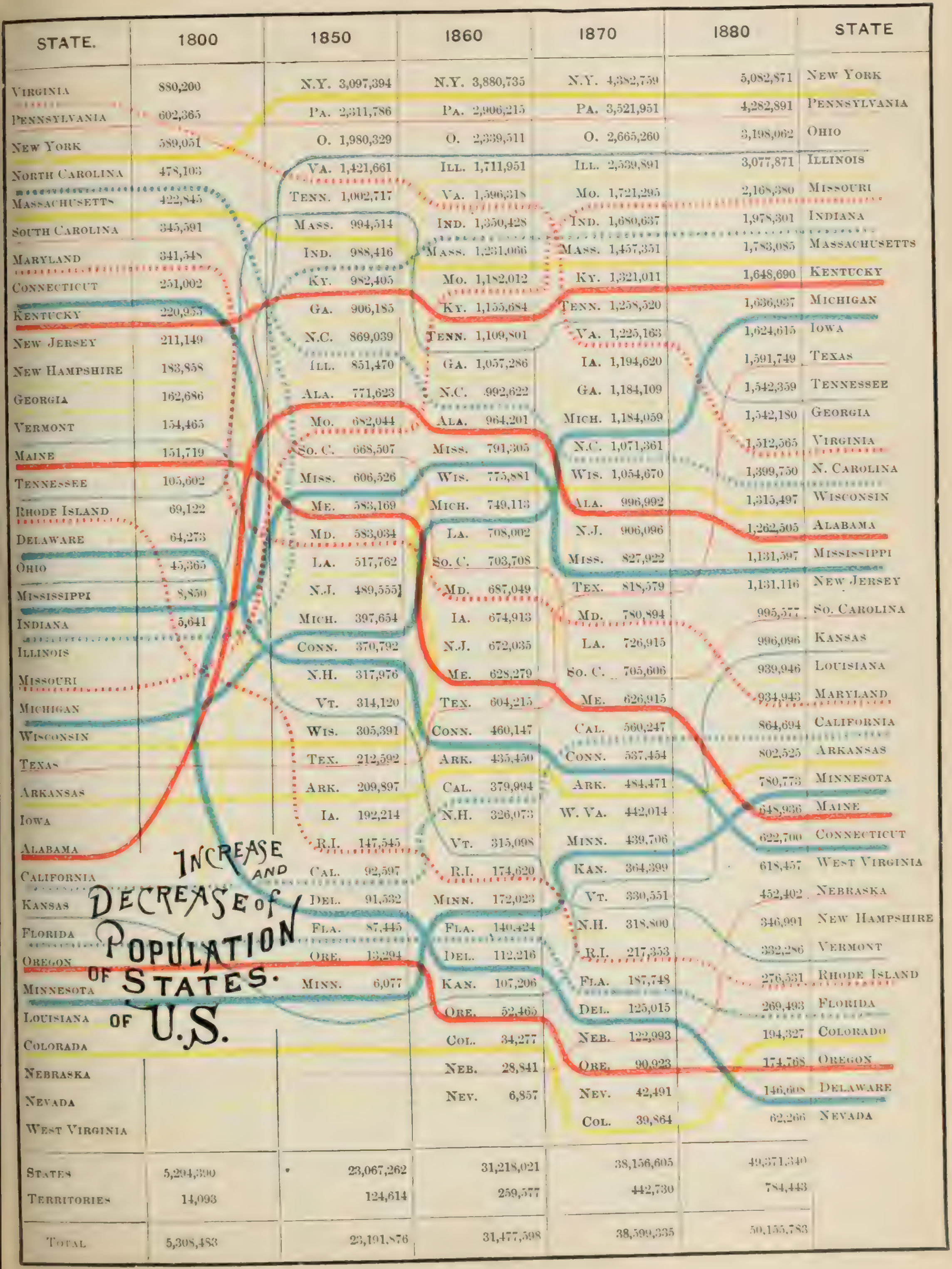



TOTAL DEBT OF VARIOUS KINDS. 1880.
$ 2,990,000,000
UNITED STATES DEBT, $1,942 000,000.
STATE AND LOCAL DEBT, $1,048,000,000,
STATE
COUNTY.
TOWNSHIP.
SCHOOL DISTRICT.
MUNICIPAL


FRANCE, $5,350,000,000.
GREAT BRITAIN, $4,450,000,000.
RUSSIA, $3,420,000,000.
SPAIN AND PORTUGAL, $3,175,000,000.
UNITED STATES, $2,986,000,000.
AUSTRIA AND HUNGARY, $2,095,000,000.
ITALY, $2,025,000,000.
TURKEY AND EGYPT, $1,760,000,000.
GERMANY, $1,075,000,000.
SOUTH AMERICA, $1,030,000,000.
INDIA, $765,000,000.
LOW COUNTRIES, NETHERLANDS, ETC., $600,000,000.
AUSTRALIA, $465,000,000.
CANADA, $199,115,000.
SWEDEN AND NORWAY, $100,000,000.
SOUTH AFRICA, $60,000,000.
DENMARK, $50,000,000.
DEBT.
VALUATION AND DEBT of NATIONS.
1880.
WEALTH
SOUTH AFRICA, $490,000,000.
DENMARK, $1,750,000,000.
AUSTRALIA, $2,450,000,000.
CANADA, $3,180,000,000.
SWEDEN AND NORWAY, $3,960,000,000.
TURKEY AND EGYPT, $3,800,000,000.
SOUTH AMERICA, $4,750,000,000.
INDIA, $6,900,000,000.
PAIN AND PORTUGAL, $8,225,000,000.
ITALY, $9,300,000,000.
OW COUNTRIES, NETHERLANDS, ETC., $11,650,000,000.
AUSTRIA AND HUNGARY, $15,250,000,000.
RUSSIA, $17,700,000,000.
GERMANY, $30,355,000,000.
FRANCE, $37,085,000,000.
GREAT BRITAIN, $44,800,000,000.
UNITED STATES, $47,475,000,000.

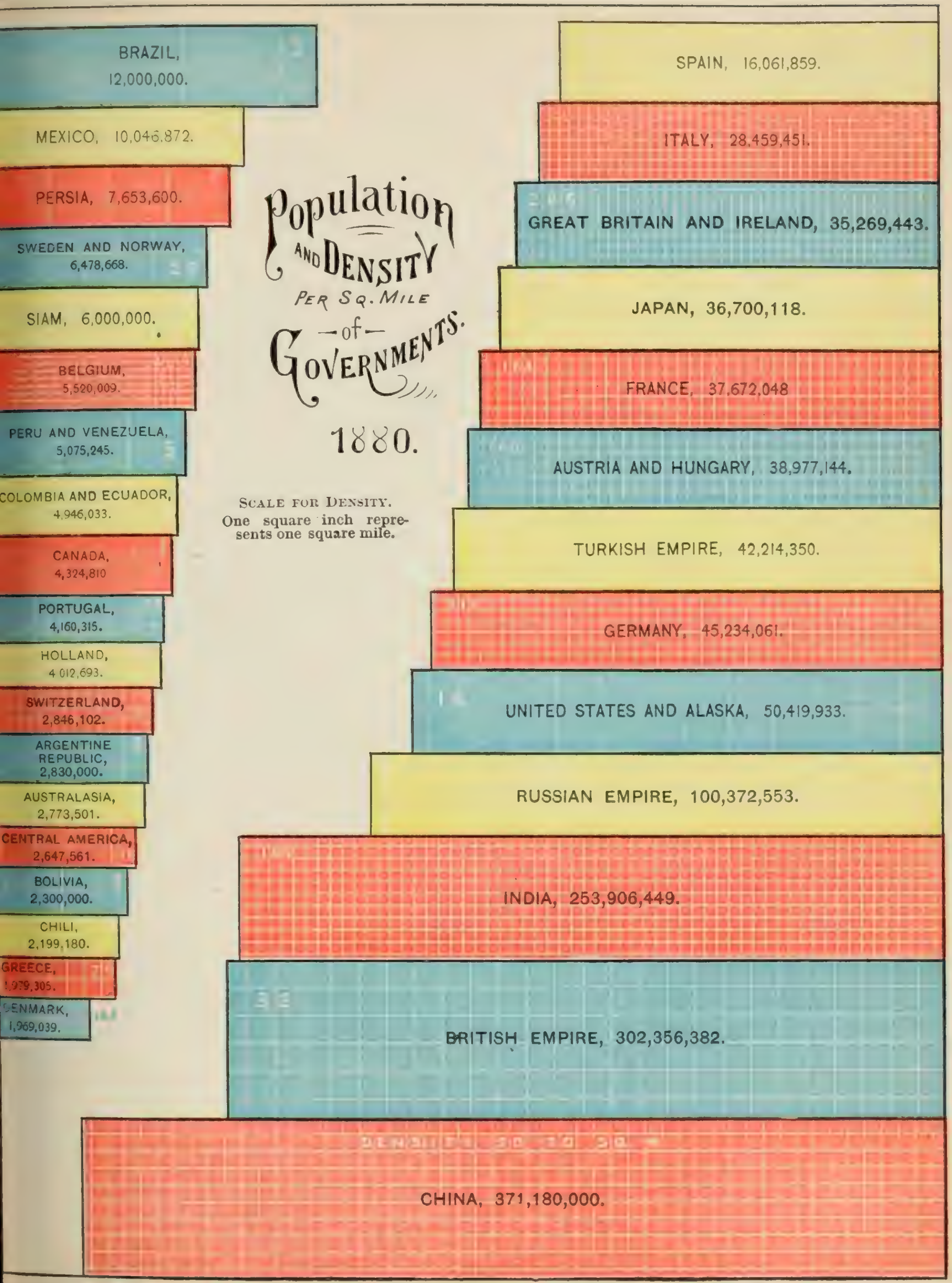

Valuation and Debts of the States
1880.
DEBT.
WEALTH.
NEW YORK, 218,723,314.
PENNSYLVANIA. 106.133.305.
MASS. 91.283.913.
MISSOURI. 57.007.384.
N. JERSEY. 49.379.727.
OHIO. 48.756.454.
ILLINOIS. 44.942.422.
LOUISIANA. 42.865.952.
VIR. 42.099.802.
TENN. 37.387.900.
DIST. COL. 22.675 459
MAINE. 22.406.850.
CONN. 22.001.661.
GA. 19.681.903.
IND. 18.354.737.
CAL. 16.755.688.
KAN. 16.005.853.
KEN. 15.118.719.
ALA. 14.728.545
S.CAR. 13.345.938.
R.I. 13.102.790.
WIS. 11.875.992.
TEX. 11.604.913.
MD. 10.896.006.
N. H. 10.724.170.
MICH. 8.803.144.
MINN. 8.476 064.
N.CAR. 8.194 606.
IOWA. 7.962 767.
ARK. 7.988.784
NEB. 7.425.757
VT. 4.352.163.
COL. 3.594.296.
FLA 2.713.333.
DEL. 2.346.585.
MISS 2.013.190.
WV 151.424.
NEV 1 024 523.
OR 848 592.
NEV. 69.000.000.
FLA. 95.000.000.
OR. 126.000.000.
DEL. 138.000 000.
COL. 149.000.000.
DIS. COL. 223.000 000.
ARK 246.000.000.
VT. 289 000.000.
NEB. 290.000.000.
S. CAR. 296.000.000
W.V. 307.000.000.
MISS. 324.000.000.
N. H. 328.000 000.
ALA. 378.000 000.
R. I. 420.000.000.
LA. 422 000.000.
N. CAR. 446.000.000.
ME. 501.000 000.
GA. 554.000.000.
KAN. 575.000.000.
MINN. 638.000.000.
TENN. 666.000.000.
VIR. 693.000.000.
TEX. 725.000.000.
CONN. 852.000.000.
MD. 869.000.000.
KEN. 880.000.000.
WIS. 969.000.000.
MICHIGAN. 1.370.000.000.
IOWA. 1.415.000.000.
CALIFORNIA. 1.430.000.000.
N. JERSEY. 1.433.000.000.
INDIANA. 1.499.000.000.
MISSOURI. 1.530.000.000.
MASS. 2.795.000.000.
ILLINOIS. 3.092.000000.
OHIO. 3.301.000.000.
PENNSYLVANIA. 5.393.000.000.
NEW YORK. 7.619.000.000.


Increase and Decrease of Population of Countries of the World



INCREASE AND DECREASE of POPULATION OF STATES. OF U.S.

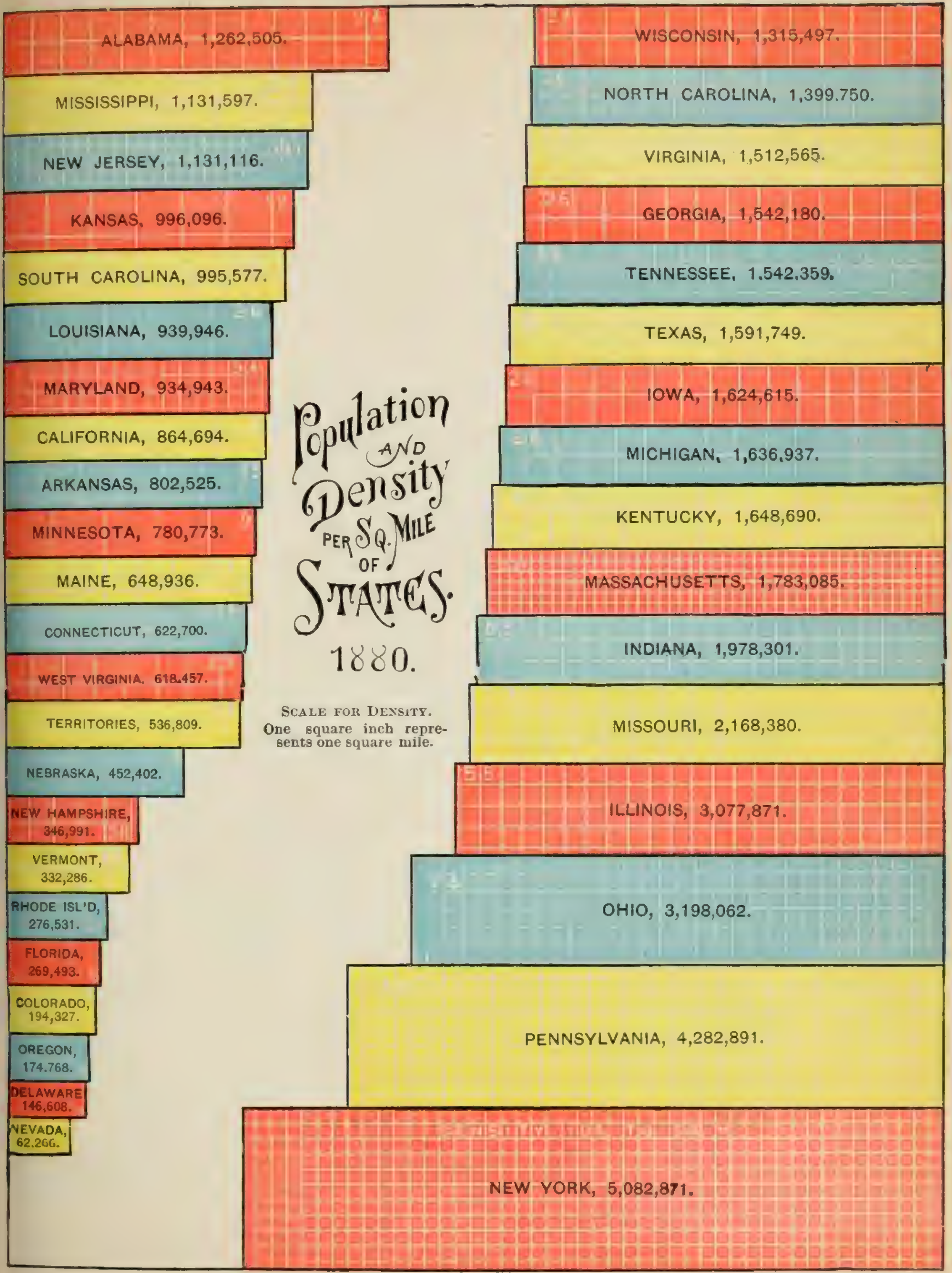
STATE.	1800	1850	1860	1870	1880	STATE
VIRGINIA	880,200	N.Y. 3,097,394	N.Y. 3,880,735	N.Y. 4,382,759	5,082,871	NEW YORK
PENNSYLVANIA	602,365	PA. 2,311,786	PA. 2,906,215	PA. 3,521,951	4,282,891	PENNSYLVANIA
NEW YORK	589,051	O. 1,980,329	O. 2,339,511	O. 2,665,260	3,198,062	OHIO
NORTH CAROLINA	478,103	VA. 1,421,661	ILL. 1,711,951	ILL. 2,539,891	3,077,871	ILLINOIS
MASSACHUSETTS	422,845	TENN. 1,002,717	VA. 1,596,318	MO. 1,721,295	2,168,380	MISSOURI
SOUTH CAROLINA	345,591	MASS. 994,514	IND. 1,350,428	IND. 1,680,637	1,978,301	INDIANA
MARYLAND	341,548	IND. 988,416	MASS. 1,231,066	MASS. 1,457,351	1,783,085	MASSACHUSETTS
CONNECTICUT	251,002	KY. 982,405	MO. 1,182,012	KY. 1,321,011	1,648,690	KENTUCKY
KENTUCKY	220,955	GA. 906,185	KY. 1,155,684	TENN. 1,258,520	1,636,937	MICHIGAN
NEW JERSEY	211,149	N.C. 869,039	TENN. 1,109,801	VA. 1,225,163	1,624,615	IOWA
NEW HAMPSHIRE	183,858	ILL. 851,470	GA. 1,057,286	IA. 1,194,620	1,591,749	TEXAS
GEORGIA	162,686	ALA. 771,623	N.C. 992,622	GA. 1,184,109	1,542,359	TENNESSEE
VERMONT	154,465	MO. 682,044	ALA. 964,201	MICH. 1,184,059	1,542,180	GEORGIA
MAINE	151,719	SO. C. 668,507	MISS. 791,305	N.C. 1,071,361	1,512,565	VIRGINIA
TENNESSEE	105,602	MISS. 606,526	WIS. 775,881	WIS. 1,054,670	1,399,750	N. CAROLINA
RHODE ISLAND	69,122	ME. 583,169	MICH. 749,113	ALA. 996,992	1,315,497	WISCONSIN
DELAWARE	64,273	MD. 583,034	LA. 708,002	N.J. 906,096	1,262,505	ALABAMA
OHIO	45,365	LA. 517,762	SO. C. 703,708	MISS. 827,922	1,131,597	MISSISSIPPI
MISSISSIPPI	8,850	N.J. 489,555	MD. 687,049	TEX. 818,579	1,131,116	NEW JERSEY
INDIANA	5,641	MICH. 397,654	IA. 674,913	MD. 780,894	995,577	SO. CAROLINA
ILLINOIS		CONN. 370,792	N.J. 672,035	LA. 726,915	996,096	KANSAS
MISSOURI		N.H. 317,976	ME. 628,279	SO. C. 705,606	939,946	LOUISIANA
MICHIGAN		VT. 314,120	TEX. 604,215	ME. 626,915	934,943	MARYLAND
WISCONSIN		WIS. 305,391	CONN. 460,147	CAL. 560,247	864,694	CALIFORNIA
TEXAS		TEX. 212,592	ARK. 435,450	CONN. 537,454	802,525	ARKANSAS
ARKANSAS		ARK. 209,897	CAL. 379,994	ARK. 484,471	780,773	MINNESOTA
IOWA		IA. 192,214	N.H. 326,073	W. VA. 442,014	648,936	MAINE
ALABAMA		R.I. 147,545	VT. 315,098	MINN. 439,706	622,700	CONNECTICUT
CALIFORNIA		CAL. 92,597	R.I. 174,620	KAN. 364,399	618,457	WEST VIRGINIA
KANSAS		DEL. 91,532	MINN. 172,023	VT. 330,551	452,402	NEBRASKA
FLORIDA		FLA. 87,445	FLA. 140,424	N.H. 318,300	346,991	NEW HAMPSHIRE
OREGON		ORE. 13,294	DEL. 112,216	R.I. 217,353	332,286	VERMONT
MINNESOTA		MINN. 6,077	KAN. 107,206	FLA. 187,748	276,531	RHODE ISLAND
LOUISIANA			ORE. 52,465	DEL. 125,015	269,493	FLORIDA
COLORADA			COL. 34,277	NEB. 122,993	194,327	COLORADO
NEBRASKA			NEB. 28,841	ORE. 90,923	174,768	OREGON
NEVADA			NEV. 6,857	NEV. 42,491	146,608	DELAWARE
WEST VIRGINIA				COL. 39,864	62,266	NEVADA
STATES	5,294,390	23,067,262	31,218,021	38,156,605	49,371,340	
TERRITORIES	14,093	124,614	259,577	442,730	784,443	
TOTAL	5,308,483	23,191,876	31,477,598	38,599,335	50,155,783	



Population and Density per Sq. Mile of Governments.

1880.

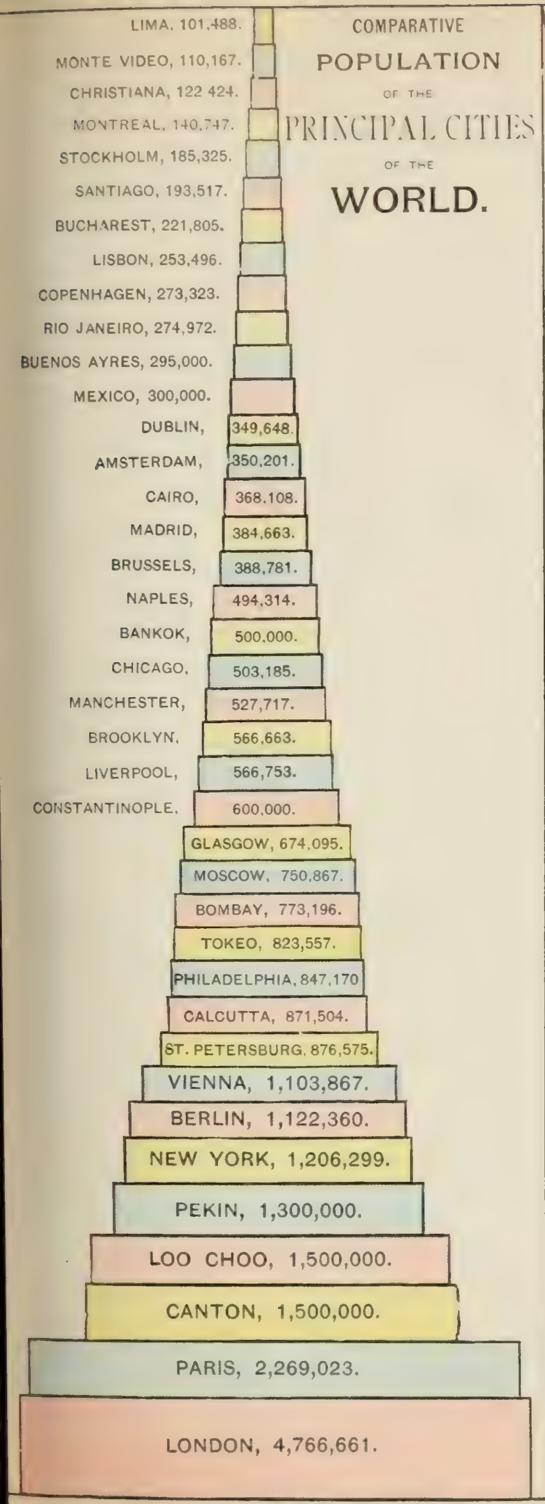
SCALE FOR DENSITY.
One square inch represents one square mile.



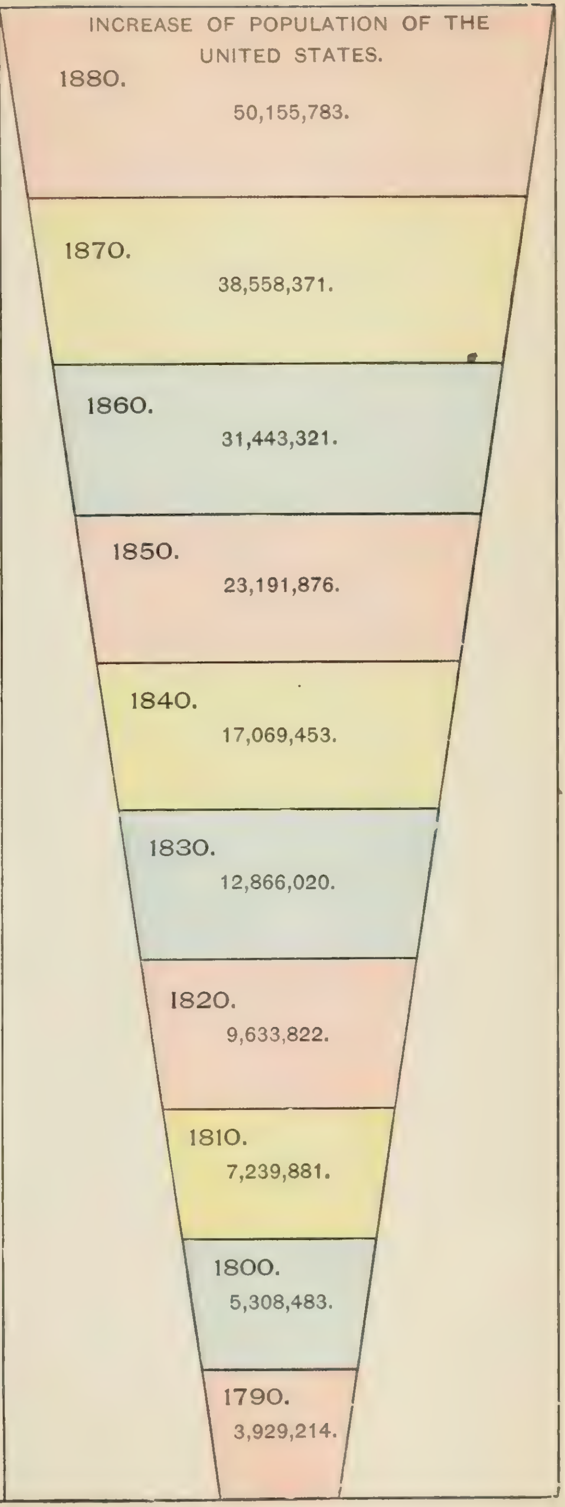
Population and Density per Sq. Mile of States.

1880.

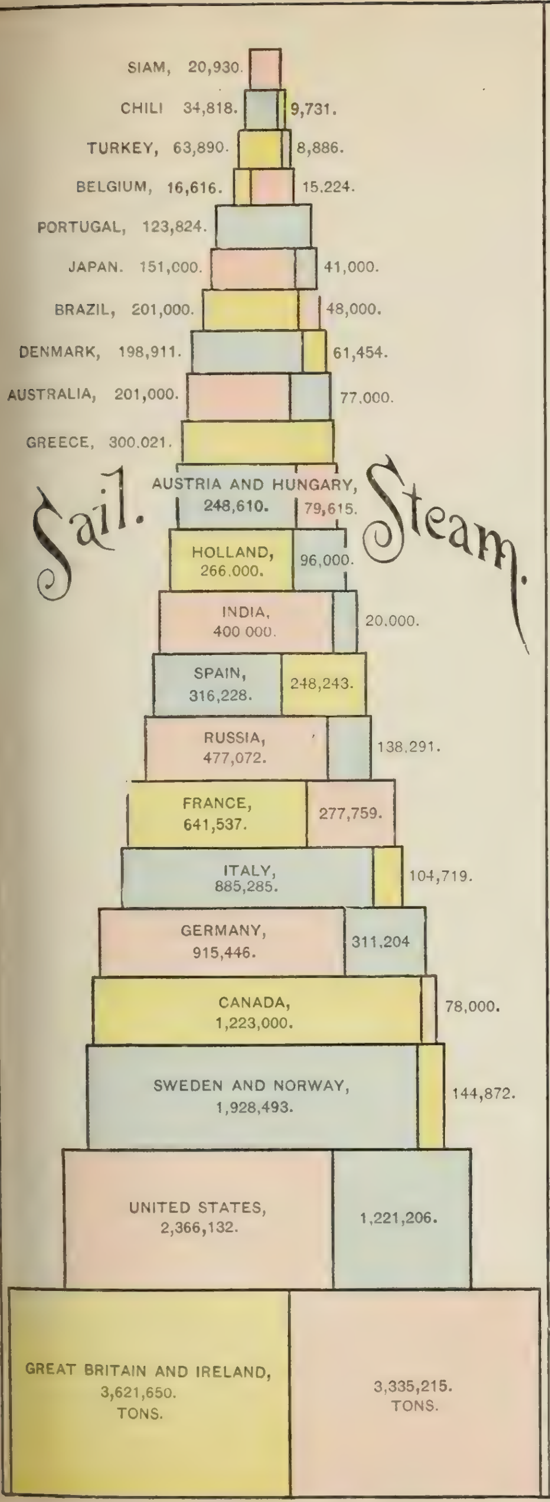
Scale for Density.
One square inch represents one square mile.

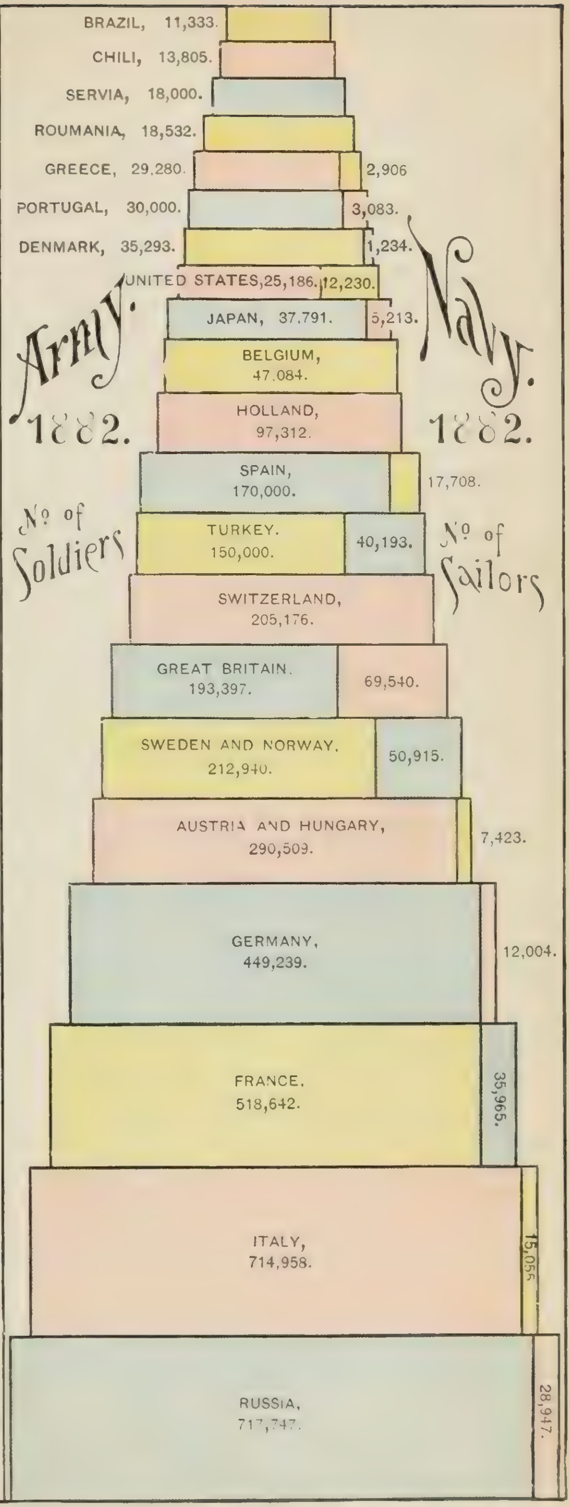


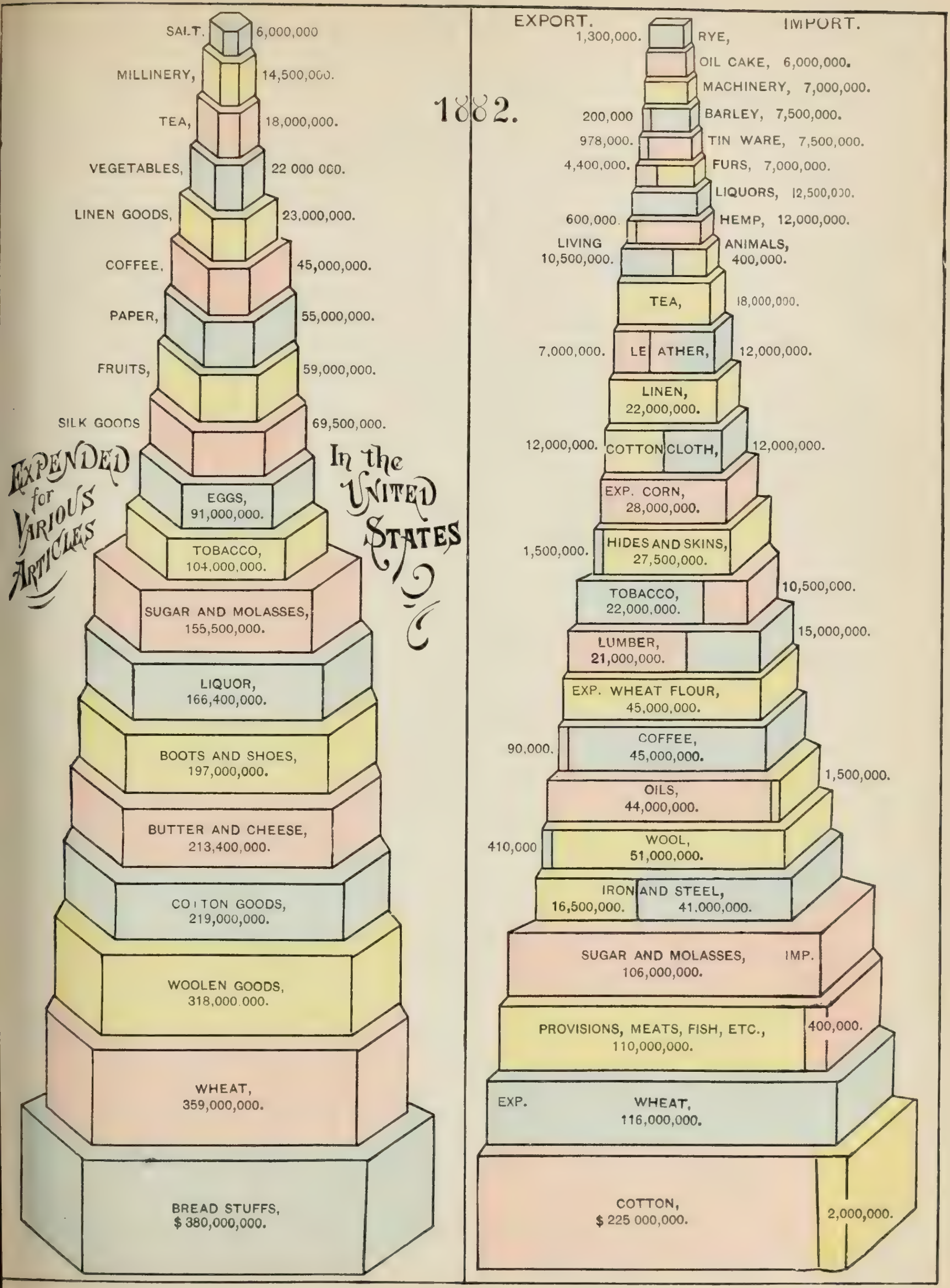
COMPARATIVE POPULATION OF THE PRINCIPAL CITIES OF THE WORLD.

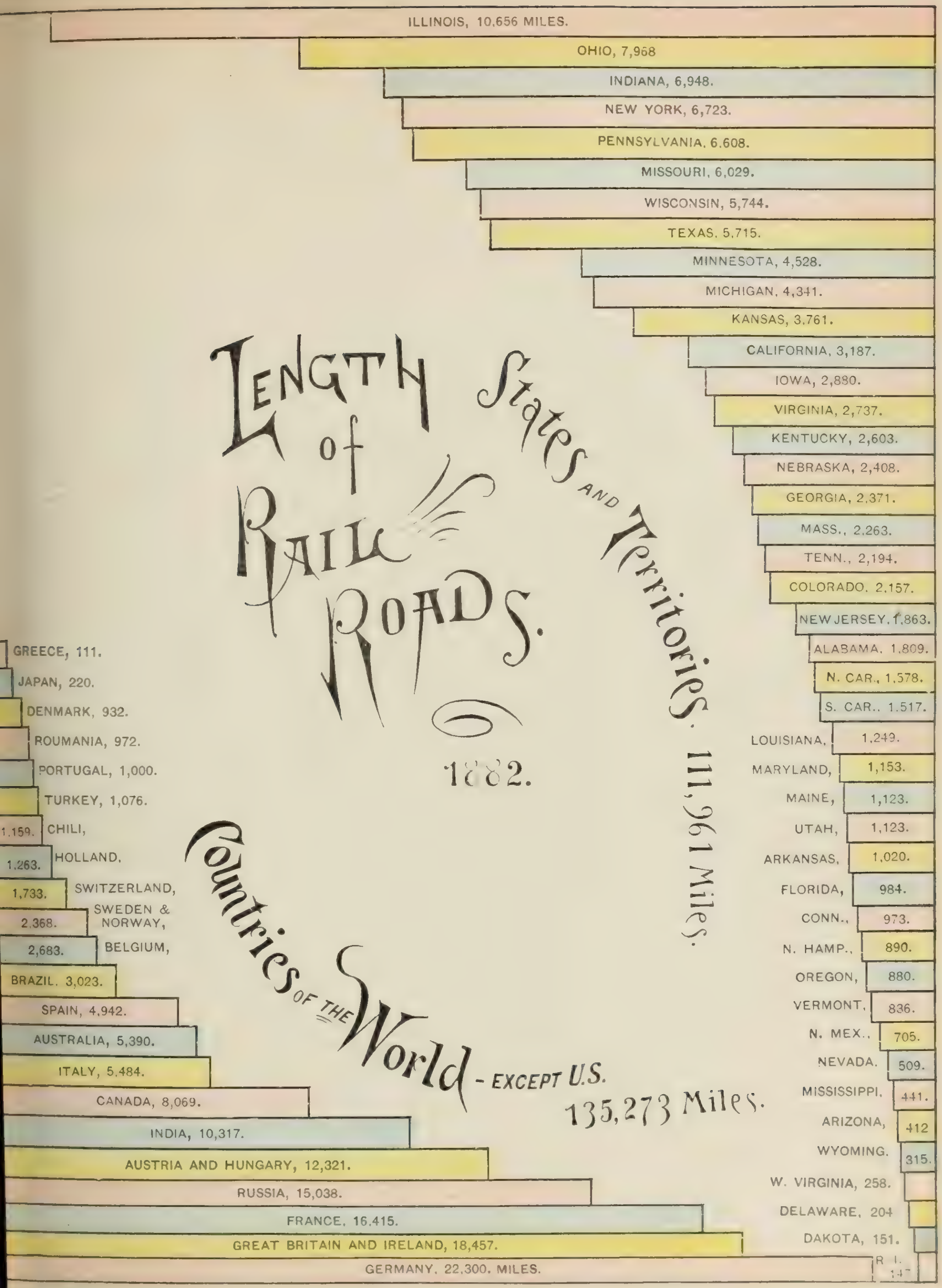


INCREASE OF POPULATION OF THE UNITED STATES.


Sail.
Steam.
SIAM, 20,930.
CHILI 34,818. 9,731.
TURKEY, 63,890. 8,886.
BELGIUM, 16,616. 15.224.
PORTUGAL, 123,824.
JAPAN. 151,000. 41,000.
BRAZIL, 201,000. 48,000.
DENMARK, 198,911. 61,454.
AUSTRALIA, 201,000. 77.000.
GREECE, 300.021.
AUSTRIA AND HUNGARY, 248,610. 79,615.
HOLLAND, 266.000. 96,000.
INDIA, 400 000. 20.000.
SPAIN, 316,228. 248,243.
RUSSIA, 477,072. 138,291.
FRANCE, 641,537. 277,759.
ITALY, 885,285. 104,719.
GERMANY, 915,446. 311,204
CANADA, 1,223,000. 78,000.
SWEDEN AND NORWAY, 1,928,493. 144,872.
UNITED STATES, 2,366,132. 1,221,206.
GREAT BRITAIN AND IRELAND, 3,621,650. TONS. 3,335,215. TONS.


Army. 1882.
Navy. 1882.
No. of Soldiers
No. of Sailors
BRAZIL, 11,333.
CHILI, 13,805.
SERVIA, 18,000.
ROUMANIA, 18,532.
GREECE, 29.280. 2,906
PORTUGAL, 30,000. 3,083.
DENMARK, 35,293. 1,234.
UNITED STATES, 25,186. 12,230.
JAPAN, 37.791. 5,213.
BELGIUM, 47.084.
HOLLAND, 97,312.
SPAIN, 170,000. 17,708.
TURKEY. 150,000. 40,193.
SWITZERLAND, 205,176.
GREAT BRITAIN. 193,397. 69,540.
SWEDEN AND NORWAY, 212,940. 50,915.
AUSTRIA AND HUNGARY, 290,509. 7,423.
GERMANY, 449,239. 12,004.
FRANCE. 518,642. 35,965.
ITALY, 714,958. 15,055
RUSSIA, 717,747. 28,947.


1882.
Expended for Various Articles In the United States
SALT. 6,000,000
MILLINERY, 14,500,000.
TEA, 18,000,000.
VEGETABLES, 22 000 000.
LINEN GOODS, 23,000,000.
COFFEE, 45,000,000.
PAPER, 55,000,000.
FRUITS, 59,000,000.
SILK GOODS 69,500,000.
EGGS, 91,000,000.
TOBACCO, 104,000,000.
SUGAR AND MOLASSES, 155,500,000.
LIQUOR, 166,400,000.
BOOTS AND SHOES, 197,000,000.
BUTTER AND CHEESE, 213,400,000.
COTTON GOODS, 219,000,000.
WOOLEN GOODS, 318,000,000.
WHEAT, 359,000,000.
BREAD STUFFS, $ 380,000,000.
EXPORT.
IMPORT.
1,300,000. RYE,
OIL CAKE, 6,000,000.
MACHINERY, 7,000,000.
200,000 BARLEY, 7,500,000.
978,000. TIN WARE, 7,500,000.
4,400,000. FURS, 7,000,000.
LIQUORS, 12,500,000.
600,000. HEMP, 12,000,000.
LIVING 10,500,000. ANIMALS, 400,000.
TEA, 18,000,000.
7,000,000. LEATHER, 12,000,000.
LINEN, 22,000,000.
12,000,000. COTTON CLOTH, 12,000,000.
EXP. CORN, 28,000,000.
1,500,000. HIDES AND SKINS, 27,500,000.
TOBACCO, 22,000,000. 10,500,000.
LUMBER, 21,000,000. 15,000,000.
EXP. WHEAT FLOUR, 45,000,000.
90,000. COFFEE, 45,000,000.
OILS, 44,000,000. 1,500,000.
410,000 WOOL, 51,000,000.
IRON AND STEEL, 16,500,000. 41,000,000.
SUGAR AND MOLASSES, IMP. 106,000,000.
PROVISIONS, MEATS, FISH, ETC., 110,000,000. 400,000.
EXP. WHEAT, 116,000,000.
COTTON, $ 225 000,000. 2,000,000.



Length of Rail Roads.

States and Territories. 111,961 Miles.

1882.

Countries of the World - except U.S. 135,273 Miles.

STATISTICS OF POPULATION.

Population of the Cities of the World, outside of America,

Having 100,000 *inhabitants or more. The latest census is the authority used, except when estimated and marked* EST.

Cities.	Population.
Amsterdam, Holland	326,196
Amoy, China, est.	250,000
Alexandria, Egypt	212,054
Antwerp, Belgium	163,011
Allahabad, India	150,378
Amritsur, India	142,381
Agra, India	137,908
Abeokuta, Africa, est.	130,000
Ahmedabad, India	116,873
Adrianople, Turkey, est.	110,000
Aberdeen, Scotland	105,054
Berlin, Prussia	1,122,360
Bombay, India	753,000
Bankok, Siam, est.	500,000
Birmingham, England	400,757
Brussels, Belgium	399,936
Breslau, Prussia	272,390
Barcelona, Spain	231,161
Bucharest, Roumania	221,805
Bordeaux, France	215,140
Benares, India	209,570
Bristol, England	206,503
Bradford, England	180,459
Belfast, Ireland	174,391
Bangalore, India	142,513
Brighton, England	128,407
Bremen, Germany	122,565
Bologna, Italy	115,957
Baroda, India	112,057
Bolton, England	105,422
Blackburn, England	104,012
Bareilly, India	101,688
Canton, China, est.	1,500,000
Chang-chow, China, est.	800,000
Calcutta, India	688,458
Constantinople, Turkey, est.	600,000
Cairo, Egypt	349,883
Chiobbe, China, est.	300,000
Copenhagen, Denmark	235,254
Cologne, Prussia	144,751
Ching-kiang, China, est.	140,000
Christiana, Norway	116,801
Colombo, Ceylon	111,942
Charkow, Russia	101,175
Dublin, Ireland	254,808
Dresden, Saxony	220,818
Delhi, India	154,417
Damascus, Turkey	150,000
Dundee, Scotland	142,454
Danzig, Prussia	108,549
Edinburg, Scotland	228,190
Foo-chow, China, est.	600,000
Foo-shan, China, est.	200,000
Florence, Italy	167,093
Frankfort on the Main, Germany	137,600
Glasgow, Scotland	511,532
Greenwich, England	169,361
Genoa, Italy	163,234
Ghent, Belgium	132,839
Hang-chow, China, est.	700,000
Hamburg, Germany	345,801
Havana, Cuba	205,676
Haidarabad, India	200,000
Hull, England	161,519
Hanover, Prussia	122,860
Hague, Holland	117,856
King-te-ching, China, est.	1,000,000
Kioto, Japan	238,563
Kien-chow, China, est.	200,000
Konigsberg, Prussia	140,896
Kieff, Russia	127,251
Kicheniff, Russia	103,998
Kharkoff, Russia	101,175
London, England	4,764,312
Liverpool, England	552,425
Lyons, France	342,815
Leeds, England	309,126
Lucknow, India	261,445
Lisbon, Portugal	253,496
Lille, France	162,775
Leipsic, Saxony	149,081
Leicester, England	122,351
Liege, Belgium	121,787
Lemberg, Austria	110,250
Moscow, Russia	611,970
Manchester with Salford, England	569,909
Madras, India	405,948
Madrid, Spain	384,636
Marseilles, France	318,868
Milan, Italy	261,976
Munich, Bavaria	230,023
Manila, Philippine Isl'ds	160,000
Magdeburg, Prussia	137,109
Malaga, Spain	112,854
Ningpoo, China, est.	500,000
Naples, Italy	448,743
Nankin, China, est.	400,000
Newcastle-on-Tyne, England	145,228
Nantes, France	122,247
Nottingham, England	111,631
Osaka, Japan	271,992
Odessa, Russia	184,719
Oldham, England	150,511
Paris, France	2,225,900
Pekin, China, est.	1,300,000
Pesth, Hungary	359,821
Palermo, Italy	219,938
Prague, Bohemia	162,318
Patna, India	158,900
Portsmouth, England	127,953
Poona, India	118,886
Rome, Italy	300,292
Riga, Russia	160,000
Rotterdam, Holland	152,587
Rouen, France	104,902
Rangoon, India	132,008
Soo-choo, China, est.	1,500,000
St. Petersburg, Russia	861,900
Si-ngan, China, est.	300,000
Sheffield, England	284,410
Shanghai, China, est.	250,000
Sidney, New So. Wales	220,427
Stockholm, Sweden	173,433
Smyrna, Asia Minor	155,000
St. Etienne, France	131,642
Stoke-upon-Trent, England	130,507
Seville, Spain	129,148
Sunderland, England	124,960
Stuttgart, Würtemberg	117,303
Strasburg, Germany	104,501
Tokio, Japan	595,905
Tientsin, China, est.	400,000
Turin, Italy	207,770
Tunis, Tunis, Africa, est.	150,000
Trieste, Austria	144,437
Toulouse, France	131,042
Tabriz, Persia, est.	120,000
Vienna, Austria	726,125
Valentia, Spain	137,581
Venice, Italy	128,901
Woo-chang, China, est.	800,000
Warsaw, Poland	336,703
Wau-chow, China, est.	200,000
Wolverhampton, Engl'd	164,303
Wednesbury, England	116,809
Yen-chow, China, est.	200,000

Population of the Cities of America, outside of the United States,

Having, according to the latest census, 30,000 or more inhabitants.

Cities.	Population.
Rio Janeiro, Brazil	274,972
Mexico, Mexico	236,500
Buenos Ayres, Argentine Republic	177,800
Montreal, Canada	140,863
Santiago, Chili	129,807
Bahia, Brazil	129,109
Pernambuco, Brazil	116,671
Montevideo, Uruguay	104,300
Lima, Peru	101,488
Valparaiso, Chili	97,737
Guadalajara, Mexico	93,875
Leon, Mexico	87,930
Toronto, Canada	86,478
Quito, Equador	80,000
La Paz, Bolivia	76,372
Puebla, Mexico	75,500
Guanajuato, Mexico	63,000
Quebec, Canada	62,447
Bogota, Colombia, est.	50,000
Cusco, Peru, est.	50,000
Caracas, Venezuela	48,897
Asuncion, Paraguay	48,000
Queretaro, Mexico	47,570
Cochanbaba, Bolivia	40,000
Morella, Mexico	36,940
Georgetown, Guiana	36,567
Halifax, N. S.	36,102
Hamilton, Canada	35,965
Para, Brazil	35,000
Puerto Callao, Peru	34,492
San Luis Potosi, Mexico	33,500
Aguas Calientes, Mexico	31,880
Maranhas, Mexico	31,604
Zacatecas, Mexico	30,083
Colima, Mexico	30,000

Population of the Cities of the United States,

Having 10,000 inhabitants or more, and of the capital cities having less than 10,000, as shown by the census of 1880.

Cities.	Population.
*Albany, N. Y.	90,758
Allegheny, Pa.	78,682
*Atlanta, Ga.	37,409
Auburn, N. Y.	21,924
Augusta, Ga.	21,881
Altoona, Pa.	19,710
Allentown, Pa.	18,063
Akron, O.	16,512
Atchison, Kas.	15,105
Alexandria, Va.	13,659
Aurora, Ill.	11,873
Amsterdam, N. Y.	11,710
Attleborough, Mass.	11,111
*Austin, Tex.	10,960
Brooklyn, N. Y.	566,663
*Boston, Mass.	362,839
Baltimore, Md.	332,313
Buffalo, N. Y.	155,134
Bridgeport, Conn.	29,148
Bay City, Mich.	20,693
Burlington, Ia.	19,450
Binghamton, N. Y.	17,317
Bloomington, Ill.	17,184
Bangor, Me.	16,856
Brockton, Mass.	13,608
Biddeford, Me.	12,651
Brookhaven, N. Y.	11,544
Burlington, Vt.	11,365
Belleville, Ill.	10,683
Chicago, Ill.	503,185
Cincinnati, O.	255,750
Cleveland, O.	160,146
Cambridge, Mass.	52,669
*Columbus, O.	51,647
Charleston, S. C.	49,984
Camden, N. J.	41,659
Covington, Ky.	29,720
Chelsea, Mass.	21,782
Cohoes, N. Y.	19,416
Council Bluffs, Ia.	18,063
Chester, Pa.	14,997
*Concord, N. H.	13,843
Chattanooga, Tenn.	12,892
Castleton, N. Y.	12,679
Cortland, N. Y.	12,664
Canton, O.	12,258
Chicopee, Mass.	11,286
Chillicothe, O.	10,938
Cumberland, Md.	10,693
Charlotte, N. C.	10,547
Columbus, Ga.	10,123
Cedar Rapids, Ia.	10,104
*Columbia, S. C.	10,036
Detroit, Mich.	116,340
Dayton, O.	38,678
*Denver, Col.	35,629
*Des Moines, Ia.	22,408
Dubuque, Ia.	22,254
Davenport, Ia.	21,831
Dover, N. H.	11,687
Danbury, Conn.	11,666
Derby, Conn.	11,650
Dallas, Tex.	10,358
Evansville, Ind.	29,280
Elizabeth, N. J.	28,229
Erie, Pa.	27,737
Elmira, N. Y.	20,541
East Saginaw, Mich.	19,016
Easton, Pa.	11,924
Eau Claire, Wis.	10,119
Fall River, Mass	49,006
Fort Wayne, Ind.	26,880
Flushing, N. Y.	15,916
Fond du Lac, Wis.	13,094
Fitchburg, Mass.	12,429
Fishkill, N. Y.	10,732
Grand Rapids, Mich.	32,016
Galveston, Tex.	22,248
Gloucester, Mass.	19,329
Georgetown, D. C.	12,578
Galesburg, Ill.	11,437
*Hartford, Conn.	42,551
Hoboken, N. J.	30,999
*Harrisburg, Pa.	30,762
Holyoke, Mass.	21,915
Haverhill, Mass.	18,472
Hempstead, N. Y.	18,164
Houston, Tex.	16,513
Hamilton, O.	12,122
Hannibal, Mo.	11,074
*Indianapolis, Ind.	75,056
Ithaca, N. Y.	11,198
Jersey City, N. J.	120,722
Johnstown, N. Y.	16,626
Jackson, Mich.	16,105
Joilet, Ill.	11,657
Jacksonville, Ill.	10,927
Jamaica, N. Y.	10,088
Kansas City, Mo.	55,785
Kingston, N. Y.	18,344
Kalamazoo, Mich.	13,552
Keokuk, Ia.	12,117

Cities.	Population.
Louisville, Ky	123,758
Lowell, Mass	59,475
Lawrence, Mass	39,151
Lynn, Mass	38,274
Lancaster, Pa	25,769
Lewiston, Me	19,083
Long Island City, N. Y.	17,129
Lexington, Ky	16,656
Leavenworth, Kas	16,546
Lynchburg, Va	15,959
Lafayette, Ind	14,860
Leadville, Col	14,820
La Crosse, Wis	14,505
Lincoln, R. I.	13,765
Lockport, N. Y.	13,522
*Little Rock, Ark	13,138
Lincoln, Neb	13,008
Logansport, Ind	11,198
Los Angeles, Cal	11,183
Lenox, N. Y.	10,246
Milwaukee, Wis	115,587
Minneapolis, Minn	46,887
Memphis, Tenn	33,592
Manchester, N. H.	32,630
Mobile, Ala	29,132
Meriden, Conn	18,340
*Montgomery, Ala	16,713
Macon, Ga	12,749
Malden, Mass	12,017
Middletown, Conn	11,732
Muskegon, Mich	11,262
*Madison, Wis	10,324
Marlborough, Mass	10,127
New York, N. Y.	1,206,299
New Orleans, La	216,090
Newark, N. J.	136,508
New Haven, Conn	62,882
*Nashville, Tenn	43,461
New Bedford, Mass	26,875
Norfolk, Va	21,966
Norwich, Conn	21,143
Newport, Ky	20,433
Newburg, N. Y.	18,049
New Brunswick, N. J.	17,166
Newton, Mass	16,995
New Albany, Ind	16,423
*Newport, R. I.	15,693
New Britain, Conn	12,979
Norwalk, Conn	13,956
New Lots, N. Y.	13,655

Cities.	Population.
Newburyport, Mass	13,538
Nashua, N. H.	13,397
Norristown, Pa	13,064
Northampton, Mass	12,172
Natchez, Miss	12,058
New London, Conn	10,537
North Adams, Mass	10,192
Oakland, Cal	34,555
Omaha, Neb	30,518
Oswego, N. Y.	21,116
Oshkosh, Wis	15,748
Orange, N. J.	13,206
Oyster Bay, N. Y.	11,923
Ogdensburg, N. Y.	10,341
Philadelphia, Pa	847,170
Pittsburg, Pa	156,389
Providence, R. I.	104,857
Paterson, N. J.	51,061
Portland, Me	33,810
Peoria, Ill	29,259
Petersburg, Va	21,656
Poughkeepsie, N. Y.	20,207
Pawtucket, R I	19,030
Pittsfield, Mass	13,367
Pottsville, Pa	13,253
Portsmouth, Va	11,390
Portmouth, O	11,321
Quincy, Ill	27,268
Quincy, Mass	10,570
Rochester, N. Y.	89,363
*Richmond, Va	63,600
Reading, Pa	43,278
Racine, Wis	16,031
*Raleigh, N. C.	13,843
Rockford, Ill	13,129
Richmond, Ind	12,742
Rutland, Vt	12,149
Rome, N. Y.	12,194
Rock Island, Ill	11,659
St. Louis, Mo	350,518
San Francisco, Cal	233,959
Syracuse, N. Y.	51,791
Scranton, Pa	45,850
*St. Paul, Minn	41,473
Springfield, Mass	33,340
St. Joseph, Mo	32,431
Savannah, Ga	30,709

Cities.	Population.
Salem, Mass	27,563
Somerville, Mass	24,933
*Sacramento, Cal	21,420
*Salt Lake City, Utah	20,768
Springfield, O.	20,730
San Antonio, Tex	20,561
*Springfield, Ill	19,743
Sandusky, O	15,838
Schenectady, N. Y.	13,655
South Bend, Ind	13,280
San Jose, Cal	12,516
Steubenville, O	12,093
Stamford, Conn	11,297
Saratoga Springs, N. Y.	10,820
Saugerties, N. Y.	10,375
Saginaw, Mich	10,525
Stockton, Cal	10,282
Shenandoah, Pa	10,147
Troy, N. Y.	56,747
Toledo, O	50,137
*Trenton, N. J.	29,910
Terre Haute, Ind	36,042
Taunton, Mass	21,213
*Topeka, Kas	15,452
Utica, N. Y.	33,914
Vicksburg, Miss	11,814
Virginia City, Nev	10,917
Washington, D. C.	147,293
Worcester, Mass	58,291
Wilmington, Del	42,478
*Wheeling, W. Va	30,737
Wilkesbarre, Pa	23,339
Watervliet, N. Y.	22,220
Waterbury, Conn	20,270
Williamsport, Pa	18,934
Wilmington, N. C.	17,350
Woonsocket, R. I.	16,050
Warwick, R. I.	12,164
Waltham, Mass	11,712
Wallkill, N. Y.	11,486
Woburn, Mass	10,931
Watertown, N. Y.	10,697
Weymouth, Mass	10,570
Winona, Minn	10,208
Yonkers, N. Y.	18,892
Youngstown, O	15,435
York, Pa	13,940
Zanesville, O	18,113

*Annapolis, Md	6,642
*Augusta, Me	8,665
*Baton Rouge, La	7,197
*Carson City, Nev	4,229
*Dover, Del	5,028
*Frankfort, Ky	6,958
*Jackson, Miss	5,204
*Jefferson City, Mo	5,271
*Lansing, Mich	8,319
*Lincoln, Neb	13,634
*Montpelier, Vt	3,219
*Salem, Ore	2,538
*Tallahassee, Fla	2,494

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* The capital of each State of the United States is indicated by an asterisk.

Table giving the Capital, Form of Government, Name of Ruler, Title, Population, and Area in Square Miles of the Principal Countries of the World.

COUNTRY.	CAPITAL.	Form of Governm't.	NAME OF RULER.	TITLE.	Population.	Area Square Miles.
Chinese Empire	Pekin	Monarchy	Kwang-u	Emperor	382,447,183*	3,924,627
British Empire	London	Monarchy	Victoria	Queen of	302,356,382	8,697,644
Great Britain and Ireland	London	Monarchy	Victoria	England	35,246,562	120,879
Canada	Ottawa	Monarchy	Victoria	and	4,352,080	3,372,290
British India	Calcutta	Monarchy	Victoria	Empress	252,833,988	1,477,763
Australia	(See History.)	Monarchy	Victoria	of India	2,773,501	3,103,903
Russian Empire	St. Petersburg	Monarchy	Alexander III	Emperor	85,426,142	8,238,771
United States and Alaska	Washington	Republic	Chester A. Arthur	President	50 185,920	3 581,228
German Empire	Berlin	Monarchy	William I	Emperor	45,238.829	212,091
France and Colonies	Paris	Republic	Jules Grévy	President	41,275.383	768,176
Austria-Hungary	Vienna	Monarchy	Francis Joseph I	Emperor	38,977,144	264,189
Japan	Tokio	Monarchy	Mutsu Hito	Mikado	32,794,897	160,474
Italy	Rome	Monarchy	Umberto I	King	28.437,091	114,296
Spain and Colonies	Madrid	Monarchy	Alphonso XII	King	23,025,207	296,436
Turkey	Constantinople	Monarchy	Abdul Hamid II	Sultan	21,000,000	1 116,848
Brazil	Rio Janeiro	Monarchy	Pedro II	Emperor	9,608,650	3,287,963
Mexico	City of Mexico	Republic	Gen. Pedro Gonzales	President	9,343,470	743,948
Belgium	Brussels	Monarchy	Leopold II	King	5,536,654	11,373
Egypt	Cairo	Monarchy	Mohamed Tewfik	Khedive	5,517,627	210,000
Norway and Sweden	Stockholm	Monarchy	Oscar II	King	5 494,901	273,848
Bavaria	Munich	Monarchy	Louis II	King	5,282,778	29,292
Persia	Teheran	Monarchy	Nassr-ed-Din	Shah	4,400,000	648,009
Portugal	Lisbon	Monarchy	Luis I	King	4,348,551	36,510
Holland or Netherlands	Amsterdam	Monarchy	William III	King	4,012,693	12,678
Colombia	Bogota	Republic	Gen. R. Nuñez	President	2 913,343	504,773
Switzerland	Berne	Republic	C. Kappeler	President	2,846 102	15,992
Peru	Lima	Republic	Don Garcia Calderon	President	2,661,063	487,798
Argentine Republic	Buenos Ayres	Republic	Gen. J. A. Roca	President	2.400,000	1,204,496
Chili	Santiago	Republic	Domingo Santa Maria	President	2,325,570	268,526
Greece	Athens	Monarchy	George I	King	1,972,775	25,101
Wurtemberg	Stuttgart	Monarchy	Charles I	King	1,971,118	7,675
Denmark	Copenhagen	Monarchy	Christian IX	King	1,969,454	21.667
Bolivia	La Paz	Republic	Dr. N. Campero	President	1,957,352	842,729
Venezuela	Caraccas	Republic	Gen. A. G. Blanco	President	1,784,194	402,261
Guatemala	Guatemala	Republic	Gen. Rufino Barrios	President	1,215,310	41,830
Ecuador	Quito	Republic	José de Veintemilla	Dictator	1 066,137	248,372

* China Proper, 362,447,183; Dependencies, 20,000,000. See History of China for remarks on present population.

Table giving the Capital, Form of Government, etc. (continued).

COUNTRY.	CAPITAL.	Form of Governm't.	NAME OF RULER.	TITLE.	Population.	Area Square Miles.
Liberia	Monrovia	Republic	A. W. Gardner	President	1,068,000	14,300
Hayti	Port au Prince	Republic	Gen. Salomon	President	572,000	10,204
Uruguay	Montevideo	Republic	Dr. F. A. Vidal	President	438,245	73,538
San Salvador	San Salvador	Republic	R. Zalvidar y Lazo	President	554,785	9,594
Nicaragua	Managua	Republic	Joaquin Zavala	President	350,000	49,500
Honduras	Comayagua	Republic	M. Aurelio Soto	President	250,000	39,600
San Domingo	San Domingo	Republic	M. Marino	President	250,000	18,045
Paraguay	Asuncion	Republic	Gen. B. Cabellero	President	239,844	57,303
Costa Rica	San Jose	Republic	Tomasi Guardia	President	190,000	26,040
Hawaii	Honolulu	Monarchy	Kalakaua I	King	56,899	6,100

Table exhibiting the Total Wealth, Debts, Exports and Imports, Revenues and Expenditures, of the principal Nations of the World in 1880.

NAME OF COUNTRY.	Amount of Wealth.	Total Debts.	Total Exports.	Total Imports.	Total Revenue.	Total Expenditure.
United States	$49,250,000,000	$2,605,000,000	$921,784,193	$753,240,125	$360,782,292	$260,712,887
Great Britain	44,800,000,000	4,450,000,000	1,432,072,330	2,056,147,825	406,365,000	420,527,770
France	37,085,000,000	5,350,000,000	775,137,400	1,037,185,200	626,145,055	626,098,845
Germany	30,355,000,000	1,075,000,000	705,375,000	973,200,000	395,075,244	491,995,566
Russia	17,700,000,000	3,420,000,000	418,466,667	395,466,667	435,548,352	469,121,794
Austria-Hungary	15,250,000,000	2,095,000,000	329,995,000	302,900,000	394,958,309	436,147,209
Low Countries .. Netherlands, etc.	11,650,000,000	600,000,000	660,829,065	790,945,000	96,545,524	105,750,484
Italy	9,300,000,000	2,025,000,000	226,133,210	244,962,540	286,904,470	285,342,395
Spain and Portugal	8,225,000,000	3,175,000,000	121,482,000	122,706,000	194,141,109	191,007,983
India	6,900,000,000	765,000,000	346,237,555	264,106,990	342,423,330	348,338,075
South America	4,750,000,000	1,030,000,000	303,019,518	218,692,903	176,124 243	185,079,029
Turkey and Egypt	3,800,000,000	1,760,000,000	166,166,017	140,249,664	104,778,713	98,935,153
Sweden and Norway	3,690,000,000	100,000,000	80,623,810	102,855,316	33,957,930	32,035,600
Canada	3,180,000,000	199,115,000	98,290,823	105,330,840	23,307,406	24,850,634
Australia	2,450,000,000	465,000,000	244,330,840	225,302,950	85,307,465	90,170,775
Denmark	1,750,000,000	50,000,000	42,576,810	53,744 310	12,756,571	11,251,561
South Africa	490,000,000	60,000,000	....	....	....	....
Total	$250,625,000,000	$29,224,115,000	$6,872,520,238	$7,787,036,330	$3,975,121,013	$4,077,165,760

Table showing, according to the Census of 1880, the Population, Debt, Assessed Valuation, and extent in Square Miles of each State and Territory; the Aggregate for the New England States, the Middle States, the Southern States, the Western States, and the Territories; and for all these united.

STATES AND TERRITORIES.	Area in Square Miles.	Population.	Amount of Taxable Property as Assessed.	Debt.
Total States and Territories	2,952,005	50,155,774	$17,371,119,268	$1,056.574,147
Maine	31,776	648,936	$235,978,716	$22,406.850
New Hampshire	9,280	346,991	200,878,016	10,724,170
Vermont	10,212	332,286	149,334,069	4,352,168
Rhode Island	1,306	276,531	328,530,559	13,102,790
Connecticut	4,674	622,700	324,388,923	22,001,661
Massachusetts	7,800	1,783,085	1,647,739,976	91,283,913
Total	65,048	4,010,529	$2,886,850,259	$163,871,552
New York	47,000	5,082,871	$2,669,111,233	$218,723,314
New Jersey	8,320	1,131,116	518,617,518	49,547,102
Pennsylvania	46,000	4,282,891	1,811,397,573	114,034,759
Delaware	2,120	146,608	100.000,000	2,346,585
Maryland	11,184	934,943	459,187,408	10,896,006
District of Columbia	60	177,624	97,980,356	22,675,459
Total	114,684	11,756,053	$5,656,294,088	$418,223,225
Virginia	40,904	1,512,565	$319,393,559	$42,099 802
West Virginia	23,000	618,457	128,559,927	1,513,424
North Carolina	50,704	1,399,750	169,916,907	8,194,606
South Carolina	29,385	995,577	124,867,085	13,345,938
Georgia	58,000	1,542,180	238,934,126	19,681,903
Florida	59,268	269,493	31,157,846	2,626,509
Alabama	50,722	1,262,505	139,077,137	14,728,545
Mississippi	47,156	1,131,597	106,198,670	2,013,190
Louisiana	41,346	939,946	149,635,805	42,865,952
Texas	274,356	1,591,749	300,525,407	11,604,913
Arkansas	52,198	802,525	86,892,541	7,938,784
Kentucky	37,600	1,648,690	356,423,946	14,977,881
Tennessee	45,600	1,542,350	211,768,438	37,387,900
Total	810,239	15,257,384	$2,363,351,394	$218,979,347

Table showing Population of States and Territories, Debt, etc. (continued).

States and Territories.	Area in Square Miles.	Population	Amount of Taxable Property as Assessed.	Debt.
Ohio	39,964	3,198,062	$1,525,445,941	$48,753,954
Indiana	33,809	1,978,301	717,796,102	18,353,737
Illinois	55,410	3,077,871	799,813,566	45,180,922
Michigan	56,451	1,636,937	810,000 000	8,803,144
Wisconsin	53,924	1,315,497	444,532,718	11,875,992
Iowa	55,045	1,624,615	393,198,305	7,962,767
Minnesota	83,531	780,773	258,055,543	8,476,064
Missouri	65,350	2,168,380	529,216,474	57,431,322
Kansas	81,318	996,096	170,813,373	16,005,853
Nebraska	75,995	452,402	93,142,457	7,425,757
Colorado	104,500	194,327	43,072,648	3,594,297
Nevada	112.090	62,266	27,598,658	1,024,523
Oregon	95,244	174,768	46,422,817	848,502
California	188,981	864,694	508,624,354	16,755,688
Total	1,101,612	18,524,989	$6,347,732,956	$252,492,522
Arizona	113,916	40,440	$5,362,903	$377,501
Dakota	147,490	135,177	20,321,528	998,860
Idaho	90,932	32,610	6,408,089	235,319
Montana	143,776	39,159	18,609,802	759,925
New Mexico	121,201	119,565	6,689,694	84,872
Utah	80,056	143,963	24,985,072	116,251
Washington	69,944	75,116	24,910,763	239,311
Wyoming	93,107	20,789	9,602,720	205,462
Total	860,422	606,819	$116,890,571	$3,017,501

In 1790 the population of the United States was 3,929,328; in 1800 it was 5,305,925; in 1810, 7,239,814; in 1820, 9,633,499; in 1830, 12,866,020; in 1840, 17,069,453; in 1850, 23,191,876; in 1860, 31,443,321; in 1870, 38,558,371; in 1880, 50,155,774.

The table before the last enables one to contrast the conditions of different countries with respect to their progress and prosperity; for instance, the United States has twice the wealth of Great Britain, in proportion to the total debts; and, while its exports and imports are both less than those of Great Britain, the exports exceed the imports by nearly $170,000,000 yearly, while the latter's imports exceed her exports by $600,000,000, — a balance of $770,000,000 in favor of this country as compared with the other. In this state of things, it is not surprising that we are enabled to reduce our debt by $100,000.000 yearly, as indicated by the excess of revenue above expenditure.

THE LAW:

A GLANCE AT ITS HISTORY

AND

GENERAL OUTLINE.

"Enlivened her with metaphors and allusions, and sent her abroad in some measure to instruct."

THE first law that we have any account of in this world was the mandate of the Lord to Adam relative to the forbidden fruit. Adam transgressed this law and was turned out of Paradise, thus establishing a precedent for the ejectments of our day; and the cherubim with the flaming sword, who were placed in possession of the premises, might well be said to be the precursors of the modern keeper; and continuing in a similar way, we find in Abram's time the first form of a conveyance in fee simple. For the Lord said to Abram, "All the lands which thou seest I give to thee and to thy seed forever;" and it is doubtful if equity would not consider that form of words sufficient in this age to create an estate in fee simple.

However, it was not until the Lord called Moses to Sinai's burning mount that mankind had any code of laws to govern them; and the Decalogue then given continues to this day as a rule of conduct, and will to the end of time, for it contains the fundamental principles of all the just laws made since its promulgation.

Again, if we look over the laws relating to justice which were given to the Jews at that time, we find that many of them bear a striking similarity to many in use to-day; *e. g.*, the Mosaic law held a man responsible for the acts of his vicious beast if he was aware of the animal's viciousness before the act, and that is good law to-day.

THE LAW OF MOSES had a tendency to inculcate the "eye for eye" principle; but when Christ announced the law from the Mount of Olives, it was found to be more in keeping with the attributes of a just and loving God whose mercy endureth forever. The keystone of the New Law, as it is called, is "that you do unto others whatsoever you would that they should do unto you"; and this sublime and perfect rule of action is to this day the guide of all law-abiding people.

Having given a cursory glance at the sacred history of the law, let us next consider its profane history, commencing with LYCURGUS, the first of GRECIAN LAW-GIVERS, who is supposed to have lived about 850 B. C.

By his code the men of *Sparta* were taught to inure their children to hunger, thirst, privation, and torture, and in addition to these, strategy and secrecy; the idea was to produce a race of warriors, vigorous and uncorrupted, and anything like æstheticism was looked upon with contempt. Although Lycurgus defined and sought to fix existing laws and customs, he dealt principally with the regulations of private life and physical culture.

624 B. C., DRACO promulgated a code which was founded on the idea that the smallest offences deserved death, and that as no severer punishment could be applied to greater ones, therefore all transgressors must be punished alike. However pleasing this code may have been to the undertakers of *Athens*, it certainly did not find favor with the rest of the people, for we find that at the beginning of the sixth century SOLON was called to remodel the laws; and so well did he perform his task that he is said to have laid the foundation of his country's happiness.

He sought to abolish the oppressive aristocracy, and to create a more democratic form of government by admitting the hard-handed men of Athens to a share of power, yet allowing the preponderance of power to remain in the higher classes. Solon's political sagacity was of an exceptional order; and to this day his name, even to the illiterate, is a synonyme of wisdom. Under his benignant teaching, Athens made wonderful progress in prosperity.

The next personage who claims our attention as a law-giver is PERICLES, the Athenian, who for forty years taught the people of Greece so well that historians designate that portion of history during which he lived as the "age of Pericles"; and it was undoubtedly one of the brightest in historic annals, for it was then that Athens reached the summit of glory: it was the admiration of the Old World, and is to-day the wonder of the New.

During this age SOCRATES, homely of visage and ascetic in habit, wandered tramp-like through the streets, uttering immortal truths. He sought to overcome the prejudice of the age, and in so doing incurred the enmity of the higher classes, and was condemned to drink a poisoned draught; which he did, and while dying he taught the doctrine of the immortality of the soul.

The mantle of the wise Socrates fell upon the shoulders of his pupil, that pure moralist Plato, whose teachings are considered to indicate the highest point of the spirituality of the ancient world.

PLATO had two pupils of whom we must speak; and one of these was DEMOSTHENES, a great orator, and persistent advocate in the courts of Greece. His denunciations of Philip stand as the most perfect models of forensic oratory.

The other pupil was ARISTOTLE, the founder of the deductive school of reasoning; and under his philosophy, men reasoned for two thousand years from abstract principles to facts. But Francis Bacon illustrated the absurdity of this system, and men were easily led to reason from known facts to general laws; and this is what is called inductive reasoning.

Aristotle taught philosophy and bad morals. Plato was pure, Aristotle was sensual, hence the difference in their teachings; but Aristotle is entitled to the credit of having raised his voice against the right of the victors in war to sell their captives into slavery.

Having devoted all the space we have to spare to Greece, we will now glance at the Roman law-givers, commencing with the Republic under VALERIUS, who struck the first blow for the people against the patricians, by granting to one condemned by the magistrates the right to appeal to the people. After that the people chose the tribunes, who had a veto power over the Senate; and one of these tribunes (VOLERO) afterwards brought about the discussion of public affairs and elections in a public meeting of the tribes, and this was the forerunner of the *New England town meeting.*

Up to this time ROME was without a code of laws, and the dissatisfaction caused thereby resulted in three commissioners being sent to Greece to get the laws of Solon and others. On their return, 451 B. C., ten senators were appointed to codify the laws, and to execute them for a year; they were called *Decemvirs*, and the result of their labors is known to the legal fraternity as the TWELVE TABLES. The Decemvirs were abolished, but their laws remained.

The next important fact connected with the legal history of Rome is that of sacrificing *Tiberius and Caius Gracchus*, the sons of Cornelia, who gave their lives to carry out existing laws which were of material benefit to the poorer classes.

Then we find the names of CICERO the eloquent humanitarian, and CATO the lawyer and philosopher, both of whom tended in a measure to broaden the scope of the laws of their time; the former taught that nothing was truly useful which was not honest.

They were both contemporaries of JULIUS CÆSAR, who, though known mostly by his great military achievements, was nevertheless a profound reasoner, and the author of many just laws as well as the reformer of the Roman code.

Passing over the time anterior to the year of our Lord 69, we find in the reign of *Vespasian*, the ninth Emperor of Rome, that *Josephus* the Jewish historian is spoken of as an advocate, ambassador from Rome to the Jews, and a law-giver of some note.

Previous to the time of FLAVIUS, a secretary of the pope, there was no code of forms for proceedings in legal tribunals accessible to the people; but he remedied that deficiency by publishing one for the people, and it was considered as a source of law second only to the Twelve Tables.

When DIOCLETIAN came into power, the mode of rendering justice was entirely changed, and thenceforth it was conducted more on the principles of equity than of established form. *Constantine* changed the constitution so much that a new form of procedure was necessary, and then JUSTINIAN revised the Roman law and brought order out of chaos.

In this Justinian had for his models the works of *Gregory*, *Hermogen*, *Theodosius*, and *Julian*. In the compilation of his Institutes he took not only the plan, but the work itself of the celebrated GAIUS (whose commentaries on the Roman law are considered an authority). Justinian was aided in his labor by *Triboman* and twenty-nine other legists.

The work is divided into three parts; viz., the *Code*, the *Digest* or *Pandects*, and the *Institutes*. They were completed Nov. 21, A. D. 533, and Justinian found then that he would have to revise the work in order to cover the latest decisions of the courts; and Tribonian again, assisted by four others, prepared a revision which issued A. D. 534. But throughout his whole reign Justinian seems to have continued at this work; and the result is known as the Civil Law, and has formed the basis of the law for the most of Continental Europe.

Before and during Justinian's time, law schools flourished at Berytus and Constantinople. In these schools the students read *Gaius*, *Ulpian*, and *Papinian*, and disputed on the writings of *Paulus*. After the publication of the Justinian Code, it became the authority and study of the students.

A. D. 887 a new revision was ordered by Emperor Basilius Macedo, and it was comprised in sixty volumes, and is known to lawyers as the *Basilica*.

Blackstone says, about this time the laws fell into neglect and oblivion till about A. D. 1130, when a copy of the Digest was found; but Savigny says this is not true. It is true, however, that the study of Roman law revived at this time, as did all other studies, which had during the Middle Ages been neglected, contrary to the wishes and great efforts of CHARLEMAGNE, who did all that he could to propagate Christianity and order.

In Europe at this time, as every one made his own law, the necessity of having a more uniform code became painfully apparent; and the scholars and the clergy brought about the adoption of the Roman law, which was the only system extant, and was adequate to the needs of the time. It was at this time, also, that a law school was established at *Bologna*, which was followed by others throughout the nations of Europe; and of course this brought to the surface a host of legal writers, among whom may be mentioned *Cujas*, *Domat*, *Heineccius*, and *Pothier*. The works of the last three are well known among the lawyers of to-day.

CUJAS was born at Toulouse in 1520, and died in 1590; he commented on the sources of the Justinian Code, for the purpose of correcting evident errors.

DOMAT (born at Clermont in Auvergne in 1625, died in 1695) wrote several treatises on the Roman law, one of which — that on Public Law — was translated into English.

HEINECCIUS (born at Lubec in 1680, died in 1741) was the first law professor and writer of his time, and was said to be the best writer of elementary works; his writings are very much admired, and his method of teaching was by axioms.

POTHIER (born at Orleans in 1699, died in 1772) is the best known of any of these to the students of our day. He was an exhaustive and painstaking writer, and his works are well considered to be the epitome of the Roman law. He wrote several treatises on the laws of France, and on obligations, contracts, and bailments. A perusal of his works will amply repay the time thus spent.

LOUIS XIV. of France was the first in Europe to restore shipwrecked property to the lawful owners, and accord their rights to shipwrecked mariners.

The political elements of the Roman law were very little used in England, but the general jurisprudence of that system was introduced by THEOBALD, a monk, and its authority admitted from the earliest times that we have any knowledge of.

ALFRED THE GREAT is said to have composed a code of laws, founded Oxford University, and established trial by jury.

WILLIAM THE CONQUEROR introduced the feudal system and the use of the Norman language into the courts of justice, and compiled the famous *Doomsday Book*, which contained a list of all the estates in the kingdom.

KING STEPHEN forbade the study of Roman law, and this was the commencement of a contest which ended in the clergy refusing to appear in the courts of common law, but they retained their control of the Chancellor's Court or court of equity.

A. D. 1215 KING JOHN granted the famous *Magna Charta* or bill of rights to the barons.

Toward the end of the reign of Henry III. the barons compelled that sovereign to delegate the regal power to twenty-four of their number, and after quite a stormy period, lasting till 1265, a Parliament assembled which included two knights from each shire and deputies from each borough; and this was the beginning of the *House of Commons*.

Next in our line comes EDWARD I., a tyrant in disposition, but evidently a wise man; for he improved the national code and administration of justice, ratified the Magna Charta, and added the clause "*no taxation without representation*," and ever since there has been a regular succession of Parliaments.

The spirit of chivalry reached its zenith in the reign of EDWARD III., and it is said that none excelled this good king and his son the *Black Prince* in that nice sense of honor, gallantry, and magnanimous feeling which were at that time held to be the attributes of a true knight. That these principles of virtue and honesty had great and good effect on the laws of the day there can be no question.

It was not until the reign of HENRY VII. that the people were allowed to convey their lands. Henry, in giving this power, dealt the feudal system a mortal wound by weakening the nobility and raising the lower orders.

During the reign of HENRY VIII. it would seem as though the law of divorce received more attention than at any time previous. It was this king who murdered, among others, that model lawyer and man SIR THOMAS MORE, at that time Chancellor of England, of whom it is said that he was the most cultivated gentleman of his time, and worthy of being classed with *Chaucer* and *Spenser* as a creator of modern English.

EDWARD COKE.

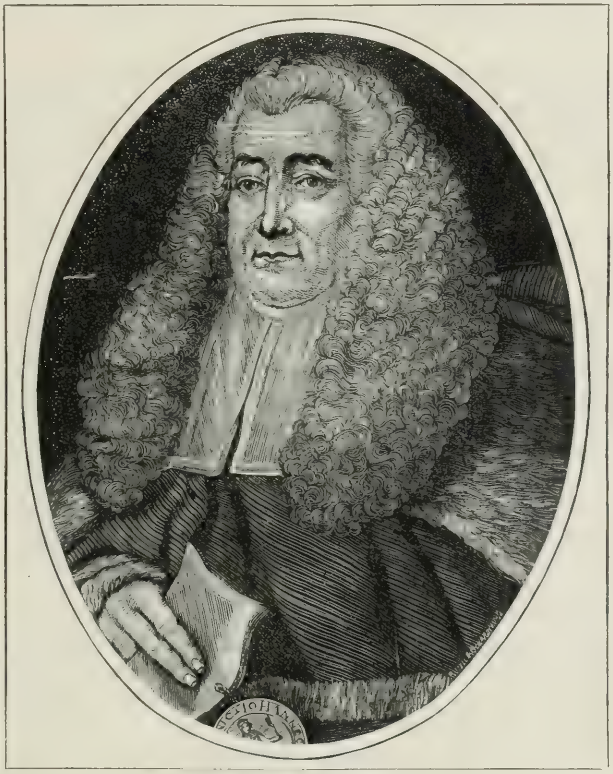
A. D. 1552 **EDWARD COKE**, the distinguished jurist and legal writer, was born; he became Attorney-General in 1592. Queen Elizabeth appointed him in preference to Francis Bacon, who also was a candidate for that office.

Coke entered Parliament in 1593, and was made Speaker the following year. In 1600 he published his volume of Reports. He was opposed to abridgments, and advised students to read the old masters, saying that " new corn springs from old fields."

As Attorney-General he was arbitrary and abusive, and extremely loyal to the Crown; but as chief justice of the Court of Common Pleas he was just the reverse. He administered justice in a just and equitable manner; he was a firm believer in the dignity of the law, and refused to allow *King James* to dictate or override the courts, and for this he was removed in 1616.

He commenced his now famous commentaries on LITTLETON, in which he interpolated many hypothetical cases, and decided them according to his own ideas of the law. He gave his only daughter in marriage to Villiers, a lifelong enemy, in order to regain his standing at court. He was reinstated as a member of the Privy Council, and entered Parliament, and from that time till his death he made it unpleasant for his old enemies, the king, Villiers, and Bacon.

Of this BACON it may be said that he was not only a lawyer, but the greatest of modern philosophers, and the organizer of inductive reasoning. He filled the offices of Attorney-General, Keeper of the Seal, and Lord High Chancellor. He was born 1561 and died 1626. His writings are said to have been GROTIUS's incentive to digest into one systematic code the principles of public right, or the law of nations, and Grotius had the honor of producing a work which has been regarded as a standard authority in every succeeding age; the more he is studied the greater our admiration.



WILLIAM BLACKSTONE.

On July 10, 1723, WILLIAM BLACKSTONE was born in London. He was left an orphan at twelve, entered college at seventeen, wrote a treatise on architecture at twenty-four, received a gold medal for his poetry, received the degree of B. C. L., June 12, 1745, was admitted to the bar in the following year. As a speaker he was far from being a success. For some time after entering the law he attracted little notice and less practice.

In 1750 he was made a D. C. L., and three years afterward commenced his lectures on the laws of England, became a professor at Oxford in 1758, commenced the publication of his famous commentaries in 1765. In five years after, he was appointed judge of Common Pleas, and the same year to the King's Bench, and was knighted.

In manner he was agreeable and facetious; he was religiously inclined, quite conservative, and a great upholder of the majesty of the law; and a *punctual* man came very near his *beau-ideal* of perfection.

Of Blackstone it is said that "he first taught jurisprudence to speak the language of the scholar and the gentleman, put a polish on that rugged science, and cleansed her from the dust and cobwebs of the office."

And now we will leave Albion and cast a hasty glance at the ancient laws of unfortunate, but to her children and scholars ever-interesting Ireland.

The legal system of Erin was called the BREHON LAW, from the *brehons* or judges of the several tribes. This code was diametrically opposed to the feudal system: the land was held by family right. It nourished a mutual independence and a self-consciousness of personal right and importance, *and under it the equality of woman was first recognized* and provided for.

These laws were finally supplanted by those of England in the seventeenth century. Whether English laws were benefited by the equitable system of Ireland we know not, but that they might have been there can be no doubt: the English government to-day has a commission at work compiling these, and scholars are enthusiastic over them.

We will now cross the Atlantic, and consider the history of the jurisprudence of the United States.

The settlers of this country brought with them the customs and many of the laws of their fatherland, and these continued in force, as far as they were practicable, in the new country, up to the time of the Declaration of Independence. From that date up to the present, our laws have been gradually assuming an individuality of their own. From the earliest period, the English laws of waste, as far as they applied to cutting down forest trees and clearing the land, were a dead letter, because, while it might be considered waste in England, it was in this country an essential benefit, as the land could not be cultivated till it was thus cleared. So, too, the cumbrous formalities of legal procedure in vogue in the old countries were quickly disposed of when the opportunity for so doing presented itself.

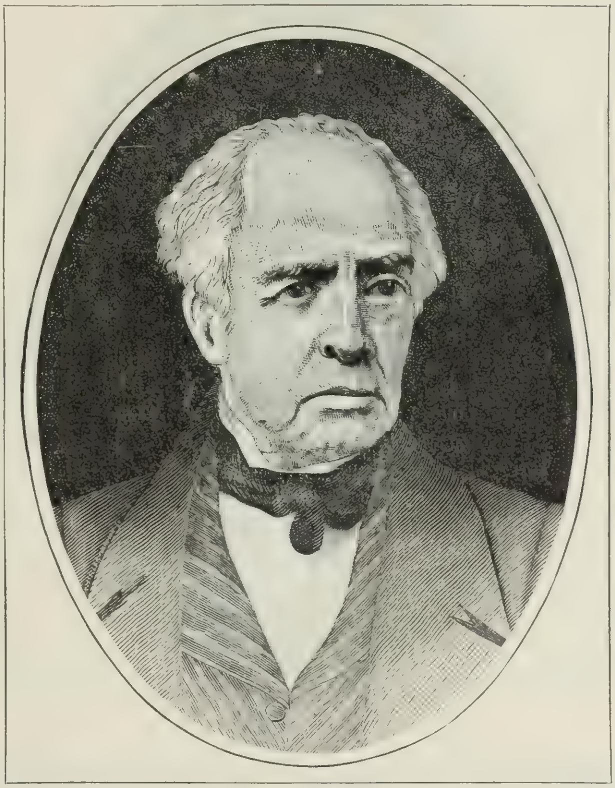
Equity proceedings in England were the especial province of the chancery courts, the judges of which never interfered with the administration of justice in the common-law courts. In this country, at quite an early day, common-law judges were empowered by law to sit in and hold courts of equity; and now it is quite common for a judge to hear law cases one term, and sit in equity the next.

Conveyance of property intended for the separate use of married women was, for centuries, an abstract idea in the minds of legists in England; and the first practical step in its furtherance was the establishment of the courts of equity, to which were given full jurisdiction in such matters. But Americans found their life too short for equity, and therefore provided by statute in the several States for the wife's separate property. The English dislike statutory reform, while the Americans seem to take a special delight in it. Land in the mother country is looked upon as almost sacred; and it is so covered up in conveying that it is almost impossible to get room enough for an attachment to lie on it. This, of course, in a great measure, may be accounted for by the conservative nature of the people and man's natural tendency to cling to his childhood's home, as well as by the scarcity of land. Men are apt to buy lands in Europe, as the deeds put it, "To have and hold forever"; while in this country men are prone to buy them for what can be made out of them.

In America, where land is so plenty and so easy of acquirement, men do not value it, generally, save for its financial worth, though some States protect land, by "homestead" and exemption statutes, from attachment for debt, more than justice seems to demand, and this is especially true of some of our Western States.

Another striking difference between English and American laws is the greater facilities which the latter afford for the disposing of lands, some of them so unceremonious as to take the English counsellor's breath away while reading them. The eldest son was always favored by the English law, and generally took the lion's share of the property, and his heirs held it by that peculiar legal device called "estates tail." There was nothing in this law of primogeniture that was congenial to the people or institutions of our country; and hence they have either been abolished or allowed to fall into disuse in all the States.

No sketch of the history of American jurisprudence would be complete which omitted the names of Kent, Story, Greenleaf, O'Conor, and Choate; and therefore we will speak of them trippingly, for our space is limited.



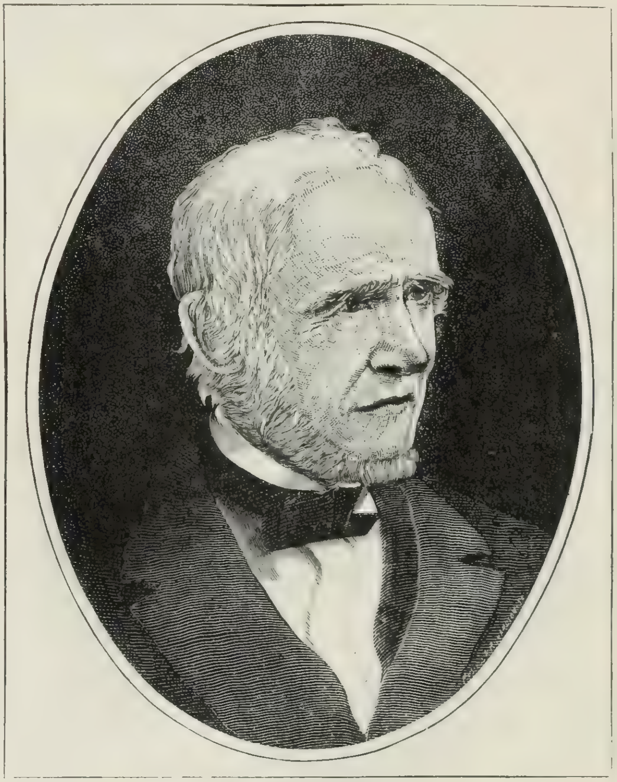
JAMES KENT.

JAMES KENT, the great Chancellor of New York and author of the world-renowned Commentaries which bear his name, was born in the town of Fredericks, N. Y., on the 31st of July, 1763; became a professor in Columbia College in 1793; and in 1798 was appointed a judge of the Supreme Court of New York, at which time he introduced the practice of delivering written decisions, — a course which has been universally followed since in the highest courts.

In 1804 he became Chief Justice, which position he held till he accepted the Chancellor's office in 1814. In this office he accomplished changes in the administration of equity and law so extensive and entire that, with the exception of Lord Nottingham's, they have no parallel in the history of the law.

In 1823, when he reached sixty years (which was the age at which the New York law *deemed a man incompetent to act as judge*), he again took up his work in Columbia College, and commenced his famous Commentaries, which were published in 1830.

He died on the 4th of December, 1847, in his eighty-fifth year, leaving a character as remarkable for its simplicity, purity, and amiability as for the highest judicial acquirements.



Charles O'Conor.

Joseph Story, the legal Gamaliel of this country's earliest days, was born in Marblehead, Mass., Sept. 18, 1779, and died in Cambridge, Sept. 10, 1845.

After having held various public offices, he was appointed justice of the Supreme Court of the United States, in 1811, when he was only thirty-two years of age, and was the youngest man ever appointed to such a position.

He became a professor of law in Harvard in 1829; and the Law School, of which he then became the head, immediately attracted students from all parts of the country.

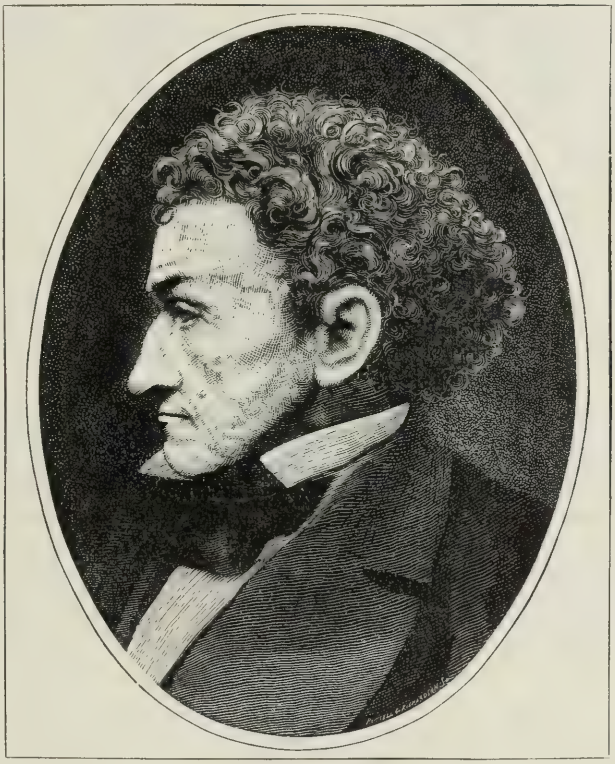
He wrote "Commentaries on the Constitution," 3 vols.; "Commentaries on the Conflict of Laws," 3 vols.; "Commentaries on Equity Jurisprudence," "Equity Pleadings."

and "Treatise on the Law of Bailments, Agency, Partnership, Bills of Exchange, and Promissory-Notes."

His solid and varied works are an enduring monument to his mental and moral worth.

SIMON GREENLEAF, whose name will ever be associated with the "Law of Evidence," was born in Newburyport, Mass., Dec. 5, 1783, and died in Cambridge, Oct. 6, 1853.

He practised law in Massachusetts and Maine, and was reporter for the Supreme Court of the latter State from 1820 to 1832, and during this period published nine volumes of reports, and a "Treatise on Freemasonry." In 1833 he entered Harvard as a professor of law, which position he held for fifteen years.



RUFUS CHOATE.

He published several works on the law, but the one on which his fame rests is his "Treatise on the Law of Evidence," which filled a gap in the legal literature of the day.

CHARLES O'CONOR, the Nestor of the New York bar, and one of the greatest of modern lawyers, was born in the city of New York on the 22d of January, 1804. He received in the course of his life just six months' schooling; the rest of his education he gained from his father's instructions. From his earliest childhood until fortune smiled on him, O'Conor endured all the pangs and privations that poverty could inflict; but he struggled on, with that grim determination which has since become the admiration of his profession, till he achieved a position of which any man in any age might be justly proud.

He has been victorious in some of the most celebrated cases which adorn our legal annals, and that, too, when opposed by such men as Thomas Addis Emmet, Van Buren, and Evarts.

He received the ultra Democratic and Labor-Reform nominations for President of the United States, and, although he declined both, yet he received 21,559 votes for that position.

Rufus Choate, the great advocate, was born in the town of Ipswich, Mass., Oct. 1, 1799, and during his lifetime was the bright particular star in the legal firmament of New England. He was distinguished for his wonderful memory, as well as for his knowledge of the principles of the law; and his unrivalled eloquence, his fidelity to his client, were only equalled by the poorness of his penmanship, which was a cipher to all save himself.

He was not only a great lawyer, but he was well and deeply read in all the literature that interests the scholar; and it is supposed Choate made the longest sentence since the days of Cadmus. He died in Halifax, N. S., on the 13th of July, 1859.

It is said that the forensic, legislative, and literary annals of his country have never been adorned by a lawyer of greater attainments, a more brilliant orator, or a more refined and accomplished scholar, than Rufus Choate.

William Beach Lawrence, the eminent publicist, legist, and jurist, was born in New York City, Oct. 23, 1800, and died March 26, 1881; was admitted to the bar in 1823; became secretary of our legation at the Court of St. James in 1826, and *charge d'affaires* in 1827. He translated Mirabeau's work on the Louisiana treaty. He delivered a course of lectures on political economy in Columbia College, which were published in 1832. acted as governor of his native State in 1851 ; and published his first edition of Wheaton's "Elements of International Law, with Annotations," in 1855 ; it is now a standard authority in all civilized countries. In 1872 he became lecturer to the Law School in Columbia College.

Among his most prominent works are, "Law of Charitable Uses," "Visitation and Search," "Commentaries on the Merits of International Law," "Treaty of Washington," "Disabilities of American Married Women abroad," "The Indirect Claims of the United States under the Treaty of Washington, May 8, 1871, as submitted to the Tribunal of Arbitration at Geneva"; "Belligerent and Sovereign Rights," "Administration of Equity Jurisprudence."

He was the Grotius of the age, and his work was scholarly and useful to the last; and jurists of all countries mourn the demise of this luminary of their profession.

OUTLINES OF THE LAW.

> "Nay, in truth I talk but coarsely,
> But I hold it comfortable for the understanding."
>
> *Beaumont and Fletcher.*

IN the following remarks the writer has sought to convey to the minds of the uninitiated, in as simple and homely a way as possible, a general idea of the law. Very little attempt has been made to go into the subtleties of the legal science, for laymen will always gladly leave them to the hair-splitting attorney.

When a person who is a stranger seeks to be directed to some point in a large and poorly laid-out city, whose streets, courts, and places start from everywhere and end nowhere, and cross each other in a perverse and confusing manner, it is worse than useless to attempt to give him all the directions at once, for in nine cases out of ten he will go wrong, for the reason that the multiplicity of turns which you told him to take have become mixed in his mind, and he is nearly as badly off as when he first inquired; therefore it would be better to point out to him the general direction in which he should go to reach the desired point, and then bid him inquire of others as he progresses on his journey; and in this connection it may be said that there is nothing so conducive to loss of time and expense as short-cuts to those who are not familiar with them; they generally verify the axiom that "Haste makes waste."

With this declaration of our intentions, we will take the reader to the broad fields of the Law, and point out to him the general direction of the respective paths, noting, in our way, some of the most prominent turns; and if our readers desire more specific information and greater detail, we will refer them to the writings of those bright legal luminaries, whose labors in their beloved fields have made the authors widely known.

I refer to, and have used in this compilation, the works of Blackstone, Kent, Washburne, Bigelow, Story, Parsons, Redfield, Wheaton, and Bouvier, as well as those of lesser renown, as Spalding, Blickensderfen, Rogers, and à Becket; and lastly, but not least, by any manner of means, the labors of the instructors of the Boston University Law School.

Asking pardon for this divergence, we proceed, first mentioning some of the legal terms and their definitions.

DEFINITIONS.

A MENSA ET THORO. — From bed and board. Not an absolute divorce.

A VINCULO MATRIMONII. — From the bonds of marriage. Absolute divorce.

ABATE. — To stop, to put an end to: *e. g.*, a suit coming to an end by the death of its party; or in business, an engagement to pay a bill of exchange when due, in money.

ABETTOR. — One who counsels or encourages another to commit a crime.

ABSCOND. — To depart in a *secret* manner from the jurisdiction of the courts, to avoid process

ACCEPTANCE. — To receive with the intention of retaining; or as in bills of exchange, agreement to pay the bill when due.

ACCIDENT. — An occurrence which is unusual, and (under the circumstances) unexpected by the person to whom to happens. In many instances it closely resembles *mistake*.

ACCOMMODATION PAPER. — Notes or bills of exchange made, accepted, or indorsed without any consideration, and for the purpose of lending credit from one to another.

ACCOMPLICE. — In its narrowest sense a person who is in a certain manner connected with the commission of a crime, but not as principal; in its full sense, any participator in a crime.

ACKNOWLEDGMENT. — A declaration, before an authorized officer, of a party who has made a deed, that it is his free act.

AN ACT OF GOD. — An accident arising from a cause not brought about by man, and which operates without his aid or interference.

ADMINISTRATOR. — A person appointed by the court to settle the affairs of the estate of an intestate, or of the estate of a testator who fails to appoint an executor, or when the executor declines to act, and then he is called *Administrator with will annexed.*

ADULT. — One of either sex who has reached the age of twenty-one years.

AFFIDAVIT. — A statement in writing made under oath before an authorized official; it is not a deposition.

ALIAS. — Otherwise called. At another time.

ALIBI. — Elsewhere. A person proving an ALIBI in a criminal case proves that he was in another place than the one described, hence, could not have committed the crime.

ALIEN. — One of foreign birth who has not been naturalized.

ALIMONY. — The allowance which a husband by order of court pays to his wife at regular intervals for her maintenance during pendency of a divorce suit, or the amount allowed the woman out of the husband's estate, upon legal separation from him.

ALUMNUS. — A foster child.

AMNESTY. — A general release by the government from the penalty or punishment which might be legally inflicted for a crime or offence. (See Pardon.)

ANIMO. — The intention. ANIMUS. — The intention with which the act was done.

ANNUITY. — A yearly sum to be paid to another as per stipulation.

Answer. — A defence in writing. Declaration of witness in response to questions.

Appeal. — Removal of a cause from an inferior to a superior court.

Appearance. — A notification presented to the clerk of the court in writing that the party will be ready for trial when the case is called, or an entrance into court as plaintiff or defendant.

Appellant. — One who appeals.

Appraiser. — One who appraises or values property.

Arbiter or Arbitrator. — A private judge to whose decision certain matters are referred by mutual consent of parties thereto.

Arraignment. — The calling of a prisoner to the bar of the court to plead *guilty* or *not guilty* to an indictment.

Articles. — A written document, or divisions of the same.

Assault. — An attempt to do violence to another within reaching distance.

Assignment. — A transfer of property, or the right thereto, by one person to another; or a writing by which such transfer is made.

Assignee. — One to whom the transfer is made.

Assignor. — One who makes the transfer.

Assumpsit. — To assume, to undertake; an undertaking express or implied; a form of action for recovering damages for breaches of simple contract.

Attachment. — When property is taken into the custody of the law it is said to be attached; and this is done by a writ issued for the purpose, and is called a writ of attachment.

Attesting Witness. — One who signs an instrument by request of parties thereto for the purpose of proving and identifying the same.

Attorney. — One who acts for another by appointment; a manager; an agent.

Authority. — That which a person must have in order to act for another; the *lawful* delegation of power from one person to another.

Bailee. — One to whom goods are intrusted.

Bailor. — One who intrusts goods to another; sometimes called pawnor, or pledgor.

Bar. — As applied to actions, means their total destruction; as an ordinary claim is *barred* by statute in six years.

Battery. — An unlawful beating, constraint, or other wrongful violence on a human being without consent.

Bequeath. — To give personal property to another by will.

Bequest. — A gift of personal property to another by will.

Bill. — A complaint in writing, as a bill in equity.

Bill of Sale. — A transfer in writing and under seal of the personal property of one person to another.

Bona Fide. — In good faith; honestly.

Bond. — An obligation in writing and under seal to perform a contract or pay a sum of money.

Burglary. — The breaking and entering of another's dwelling-house, or place of abode, *at night*, with intent to steal or commit a felony.

Capias. — A writ directing the officer to take the body of the person named into custody.

Capital Crime. — One which is punishable by death.

Carte Blanche. — Signifies that full power in the premises has been given by one party to another, — as a note signed in blank.

Casualty. — That which no man foresees, aids, or can guard against.

Caveat. — Let him beware (who buys or sells); a warning used mostly in matters relating to infringements on patents.

Character. — The opinion generally held of a person by those who know him.

Chattel. — Every species of personal property as distinguished from real estate.

Chose in Action. — A thing, as a debt or demand, which a man has the right to recover by action at law.

Codicil. — A supplement or addition to a last will and testament.

Coercion. — Compulsion; restraint.

Collusion. — A secret agreement for a fraudulent purpose between two or more persons.

Common Carriers. — Parties who, for hire, carry goods for all persons.

Common Law. — That body of rules and customs which has acquired its binding power and force of law through usage and recorded judicial decisions; it is distinguished from statute law, which owes its authority to acts of the legislature.

Competency. — The legal ability of a person to do any act.

Composition. — The agreement between debtor and creditor, whereby the latter agrees to take part of the debt in satisfaction of the whole.

Concealment. — The suppressing or secreting of a material fact by one of the parties to a contract from the other.

Condition. — Stipulation; terms of contract; the assigning to each person a separate rank in the different orders which compose society.

Construction. — The interpretation, as to the matter under consideration, of the provisions of any written instrument or oral agreement.

Covenant. — An agreement or contract under seal.

Coverture. — The legal condition of a married woman.

Crim. Con. — An abbreviation of *criminal conversation*, denoting illegal sexual intercourse with a married woman.

Curtesy. — A species of freehold estate not acquired by inheritance, but rather by favor of law; the interest of a husband in a wife's estate is said to be that of curtesy.

Damages. — The pecuniary satisfaction or indemnity awarded for an injury sustained through the act or negligence of another.

De Facto. — In fact; actual.

De Jure. — By right; lawfully.

Declaration. — An explicit statement in proper form of the circumstances which constitute the plaintiff's cause of action.

Deed. — An instrument in writing between parties able to contract, and duly sealed and delivered.

Default (in practice). — Failure to appear in court within time prescribed by law. Failure in the performance of any contract or stipulation.

Delivery (contracts). — Transferring the possession of a thing from one person to another.

Demand (in practice). — A request for a thing due or claimed to be due.

Demise. — The conveyance of an estate either in fee, for life, or for a term of years.

Deposition. — The testimony of a witness reduced to writing as given before some judicial officer, to be used on the trial of some question of fact in a court of justice; admits of cross-examination.

Descent. — The transmitting of estates by inheritance. Title by descent is the title by which one person, upon the death of another, acquires the real estate of the latter as his heir at law.

Devise. — A gift or disposition of real property by a person's last will and testament.

Disability. — Legal incapacity, such as infancy, insanity, coverture, etc.

Distress. — The taking of a personal chattel out of the possession of a wrong-doer into the custody of the party injured to procure satisfaction for the wrong done.

DOCKET. — A brief and formal record of court proceedings.

DOWER. — That portion of a man's lands and tenements to which his widow is entitled during her life.

EMBLEMENTS. — The produce of land sown. Such products of the land as have resulted from the tenant's labor, and which he has the right to take away after the termination of his tenancy.

EQUITY. — Material justice. Court of equity is one established for the application of the principles of natural right and reason in the administration of justice when there is no relief at law. (See Equity.)

ESTOPPEL. — An impediment in law by which a man is precluded from asserting a fact in consequence of his previous conduct being inconsistent therewith; as if I sign my name to a document as Jones, I am estopped from afterwards pleading a misnomer.

EX OFFICIO. — By virtue of his office.

EX PARTE. — From only one side of the matter in question.

EX POST FACTO LAW. — A law which makes an act *criminal*, which was not a crime, or *punishable*, in a manner in which it was not punishable *when done*.

EXCEPTION (in practice). — An objection as to the judge's ruling expressed during the trial. Bill of exceptions. A written statement of the exceptions taken in the trial of a cause.

EXECUTOR. — One to whom another man commits by his last will the execution of that will and testament.

EXEMPLARY DAMAGES. — The indemnity given as a punishment for torts committed with violence, malice, or fraud.

EXEMPTION. — The privilege given by law to a debtor to hold a portion of his property without its being subject to execution upon any judgment obtained against him.

EXTORTION. — The illegal exaction by any officer of anything that is not due to him, or more than is due, or before it is due.

FACTOR (see Attorney). — A person employed to sell goods delivered to him. He always has possession of the goods, and thus differs from a broker, who sells by sample.

FALSE PRETENCES. — False representations made to obtain money or goods with intent to cheat.

FEE SIMPLE. — An absolute estate of inheritance; called simple from the fact of its being free from any restriction or limitation to particular heirs. Lands thus held are by owner's own right.

FEUDAL LAW. — The law by which estates in land of a superior were held on condition of military services.

FIXTURES. — Personal chattels fixed to a house, which can be removed by the party placing them there or his representative, against the will of the owner of the freehold.

FORECLOSURE. — The process by which the equity of redemption of a mortgagor is barred. Depriving a person of the power of redeeming a mortgage.

FORGERY. — The fraudulent making and alteration of a writing to the prejudice of another man's right.

FRAUD. — Deception deliberately practised with a view to gaining an unlawful or unfair advantage.

FRAUDS, STATUTE OF. — Refers to statute entitled "An Act for the Prevention of Frauds and Perjuries," passed in the reign of Charles II., the object of which is to require certain transactions to be in writing.

FULL AGE. — The age of twenty-one for both males and females, except in Vermont and Ohio, where a woman reaches full age at eighteen.

GARNISHEE (see Trustee). — A person in whose hands money or property is attached by the creditor of another, and who has had notice of such attachment.

GRAND JURY. — A body of men consisting of not less than twelve nor more than twenty-three, who hear *accusations* in criminal cases, and if sustained by evidence find indictments against those complained of.

GRAND LARCENY (same as Compound Larceny).

GRANT. — A conveyance of real property by deed or writing.

GRANTEE. — The party to whom a grant is made.

GRANTOR. — The party by whom a grant is made.

GUARANTY. — A promise or guarantee that the debtor shall pay. It differs from a surety inasmuch as the latter promises that the debt shall be paid.

GUARDIAN. — One who has legally the care and management of the person or estate, or both.

GUARDIAN AD LITEM. — A person appointed by the court to manage the interests of another in a suit.

HEAD OF FAMILY. — The one who provides for a family.

HIGH-WATER MARK. — The line or mark made on the shore by the tide when it is at its highest point.

HIGHWAY. — A road over which every citizen has the right of passage.

HOMESTEAD. — The home place with land adjoining. The meaning and extent of the term are to be drawn from the context of a deed when the word is mentioned there.

HOMICIDE. — The killing of a human being by a human being. It is of three kinds, — excusable, felonious, and justifiable.

HOUSE-BREAKING. — The forcible entry of a house for unlawful purposes by *daylight.* (See Burglarly.)

HOUSEHOLD FURNITURE. — All personal chattels that add to the convenience or use of the household, or the ornamentation of the house.

HOUSEHOLD GOODS. — Everything used or of use in the house, except commodities for sustenance, and goods kept for trading purposes.

HYPOTHECATION. — A pledge without delivery of the goods pledged. The right of a creditor to indemnify himself by proceeds of sale of goods hypothecated.

I. O. U. — A written *acknowledgment* of debt.

IN PERSONAM. — A remedy where the proceedings, instead of being against specific things, are against the person.

IN RE. — In matter of.

IN REM. — A term denoting that proceedings are against specific things, in contradistinction to the person.

IN STATU QUO. — As it was; in the former state.

INCUMBRANCE. — Liabilities resting on an estate.

INDEMNITY. — Reimbursement or compensation for loss sustained.

INDENTURES. — An instrument in writing between two or more persons having different interests containing a contract.

INDICTMENT. — A written accusation of a crime or misdemeanor preferred by a grand jury against some persons or persons, and presented, under oath, to a court.

INFANT. — A person not of age, or under twenty-one years of age.

INFRINGEMENT. — A violation of the rights of a patentee.

INSOLVENCY. — The state of a person who, from any cause, is unable to pay his debts.

INSTRUMENT. — The writing which sets forth some agreement, and which is used as an evidence of what has been agreed upon.

INTERPRETATION. — The explanation of the true meaning of any signs used to convey ideas.

INTESTATE. — One who has made *no* will, or who, having made one, renders it *null* by *not* having it in *due form.*

INVENTION. — The devising of something which had *not* before existed. It also signifies the thing so devised.

INVENTORY. — An enumeration in writing of the goods, chattels, and credits (and in some cases real estate) of a testator or intestate.

ISSUE. — In real law, children. In pleading, a material point in a suit affirmed by one side and denied by the other.

JEOPARDY. — Hazard, danger, peril. A prisoner is said to be in jeopardy when a jury is duly impanelled to try his case.

JUDGMENT. — The conclusion of the law pronounced by the Court upon facts found in the record, or upon the default of the parties in the course of the suit.

JURISDICTION. — The constitutional power conferred on judicial officers to take cognizance of and decide causes, and to carry their sentence into execution.

JURISPRUDENCE. — The science of law; the science which wisely interprets and applies law.

JUSTIFICATION. — The act by which the defendant shows a good and legal reason for doing the thing complained of.

KINDRED. — Blood relations. Nature's divisions of kindred are descendants, ascendants, or collaterals; thus a child is a descendant of his father, the father the ascendant of his child. Brother is collateral.

LARCENY. — Simple, is the unlawful taking from any place, without the consent of the owner, the personal goods of the latter, with the intention of converting them to taker's use. Compound, or Grand Larceny, is larceny committed under circumstances which, in the eye of the law, render the crime more aggravated.

LACHES. — Negligence, remissness. The delay in enforcing a person's right through lapse of time.

LEGACY. — A gift of goods and chattels by a will and testament.

LEVY. — To raise. Practically, the obtaining of the money for which an execution has been issued.

LINE OF DESCENT. — The list of persons who have sprung from a common ancestor, placed consecutively in the order of their birth, one under the other.

MAINTENANCE. — Support, assistance, protection.

MANSLAUGHTER. — The unlawful killing of another without malice or deliberate intention, both when voluntary, but unpremeditated, and when involuntary, but as the result of performing some unlawful act.

MESNE PROCESS. — Covers any proceedings between the primary and final process; or, the original writ and the writ of execution.

MINOR. — A person under twenty-one years of age

MISDEMEANOR. — An offence which is indictable, but does not amount to felony. The crimes for which the law has not provided a particular name are usually styled misdemeanors.

MORAL OBLIGATION. — A duty which a person ought to perform, but which he is not legally bound to.

MURDER. — The killing a person with malice aforethought. Any murder committed in the perpetration of any crime, or by any kind of wilful, deliberate, and premeditated killing, is deemed murder in the first degree. All other kinds of murder are deemed murder in the second degree.

NEW PROMISE. — The contract made after the first promise has been rendered invalid, by which the promisor agrees to fulfil the original promise. (See Revivor.)

NEXT OF KIN. — The nearest blood relations of a party who has died intestate.

NON-SUIT. — The relinquishment of a cause on the part of a plaintiff at the trial, either by order of the Court or voluntarily.

Nuisance. — Anything that unlawfully worketh hurt, inconvenience, or damage.

Ordinary Care. — That degree of care which men, who are ordinarily prudent, exercise in providing security for their own property.

Perils of the Sea. — Danger to which goods are exposed in carriage, the effects of which carriers do not undertake to insure against.

Perishable Goods. — Goods which become worse by being kept, and are thereby lessened in value.

Perjury. — The crime committed in some judicial proceeding when a person to whom a lawful oath is administered swears absolutely and *falsely*, with that intent, in a matter material to the point in question.

Petit Jury. — An ordinary jury of twelve men. Also called a Traverse Jury.

Pleading. — Is the statement, in a legal and logical manner, of the plaintiff's cause of action or of the defendant's ground of defence.

Practice. — The carrying on of suits, through their various stages, in the courts, and in the form and order laid down and prescribed.

Preference. — The securing or paying to any of his creditors, by an insolvent debtor, the whole or any portion of their claim, to the exclusion of the others. This is allowed in some States.

Premeditation. — The formation of a design to commit a crime, or do some other thing before it is done.

Prima Facie. — At the first sight or view; on the face.

Process. — The entire proceedings in any action, from beginning to end, whether civil or criminal, real or personal.

Quash. — To overthrow, to make void; especially applied to indictments. Courts quash proceedings when they are plainly irregular or when obtainable evidence is not sufficient to make conviction probable.

Quasi. — A term used to denote a resemblance with a difference.

Receipt. — A written acknowledgment for money or property received.

Replevin. — A form of action which lies to recover possession of goods taken or held unlawfully.

Return Day. — The day which the law appoints when all writs are to be returned which have issued since the preceding writ-day.

Revivor. — The act or steps of renewing a matter which is abated or inoperative.

Robbery. — The act of feloniously taking money or goods from the person of another by violence or putting him in fear.

Salvage. — A compensation given by maritime law for preserving or saving a vessel or its cargo from wreck or loss.

Scilicet, SS. — To wit: namely. A preliminary phrase to usher in the sentence of another, or to explain what was obscure or doubtful.

Seal. — Wax, wafer, or other tenacious substance capable of being impressed. Seals are affixed to legal instruments in token of performance or authenticity.

Sine Die. — Literally, without day. When a court rises at the end of a session, it is adjourned *sine die.*

Slander. — The utterance of defamatory, false, and malicious words tending to injure the character of another.

Stay of Execution. — The time during which no execution can issue on a judgment.

Subornation of Perjury. — The procuring of another to commit perjury. To complete the offence, the false oath must be actually taken. To solicit without success will not complete the crime.

Surety. — One who binds himself for another, called the principal, who is originally liable.

Tender. — An offer of immediate delivery.

Testament. — A formal, legal declaration of a person's will, in regard to the disposition which he desires shall be made of his property after his death; a will.

Testator. — One who makes, or has made, a testament or will.

Third Parties. — Those who are not parties to the contract.

Threats. — A menace of injury to the property, character, or lives of those against whom it is made.

Title. — That which gives a right or claim to ownership.

Traverse. — To deny; to plead not guilty to.

Trespass. — A direct injury to person or property by any one.

Trover. — An action to recover the value of goods or personal chattels wrongfully converted by another to his own use.

Trustee. — A person to whom is committed some estate, interest, or power affecting property on behalf of another.

Trustee Process. — The process by which a creditor may attach any goods, property, or credits of a debtor in the hands of a third person.

Usury. — The excess over the legal rate of interest charged to a borrower for the use of money.

Utter. — To publish; to offer.

Valid. — Having all the effect, force, and strength of law.

Variance. — Occurs where the evidence does not support the allegations.

Vendor. — The person who sells.

Vendee. —.The party to whom anything is sold.

Venue. — A neighborhood, place, or county in which an injury is said to have been done or the act in question performed; the county whence the jury will be summoned, and in which the trial will take place.

Versus. — Against; commonly written *vs.* or *v.*

Vest. — To put in possession; to give a fixed right of present or future enjoyment.

Void. — Having no effect or force.

Voidable. — That may be annulled legally on account of some inherent quality; not void, but may be made so, though having some force or effect.

Warranty. — A verbal or written stipulation that a certain fact in relation to the subject of a contract is or shall be as it is stated or promised to be.

Will. — Is that by which a person makes a disposition of his property, to take effect after death. (See Testament.)

Witness. — One who testifies under oath to something which he knows otherwise than by hearsay.

Writ. — An instrument in law by which a court commands some act to be done by the person to whom it is directed.

Waiver. — The relinquishment or surrender of a claim, privilege or right.

Waifs. — Goods stolen or thrown away by the thief in his flight, for fear of being apprehended.

Ward of Chancery, or of Court. — A minor, lunatic, etc., under the protection of the Court of Chancery, or of a Court of Equity.

Without Prejudice. — This phrase is employed to signify that what is said or done is not to effect a controversy or question.

Without Recourse. — Upon the sale or transfer of a promissory note by indorsement, "without recourse," the vendor impliedly warrants that the signatures of the prior parties whose names appear thereon are genuine. The words "without recourse" accompanying an indorsement, indicate that the party making the transfer does not intend to assume the position of an unconditional indorser, or to incur any liability if the note is not paid at maturity upon due demand.

REAL PROPERTY

THE two great divisions of property are real and personal; and this division had its origin in the nature of the remedy sought by one deprived of possession. In the case of lands he recovered, if at all, the real thing lost; but if a chattel, his remedy was generally against the person who had taken it away.

It is not always easy to draw the line between personal and real property, for a house or a standing tree may be personal property, as in the case where I erect a house on another's land under certain conditions, while portable articles may come to have the qualities of real estate by the very nature of the use to which they are fitted or applied.

Land is always classed as Real Property, and so is ordinarily whatever is growing or erected on it, as well as what is beneath its surface. But to make a thing a part of the realty by merely annexing it, requires that he who annexes the personal article should own both it and the soil on which it is erected. If I attach a machine or anything else to a house in such a manner that to remove it necessitates the destruction of the house, and then I sell or mortgage that house to one not knowing to the facts, it will be held to have passed the title to the machine; and if the machine is hired, then the owner of the machine must look for his pay to the one to whom he let it. This principle would apply where I used the material of another to build my house, and then conveyed to a party ignorant of the facts.

Trees planted by nurserymen for the purpose of transplanting and sale are personal property; or if trees or crops are sold to be cut or removed, they are personal property, unless the vendee is given the right to occupy vendor's land to grow or support them.

Crops fit for harvesting may be levied on as chattels. If I give you and your heirs the liberty to cut and convey away the trees on my land at your pleasure forever, you acquire an estate in fee in the trees, with an interest in the soil sufficient to support them, while the fee remains in me.

Keys, blinds, bolts, and various other kinds of personal property become real estate as it were by their attachment to the realty.

Rolling Stock, cars, and engines are part of the realty, but the stockholders' interest is personal property. Fence rails are real estate. A personal thing when it partakes of the nature of the realty is called a fixture; and the law says it must be something substantially and permanently affixed to the soil, though portable in its nature.

As a general rule, whatever a tenant affixes to leased premises he may remove if he can do so without material injury to the premises, and a conveyance by his landlord to another will not defeat his right; but the tenant must remove the fixture before the expiration of his term, otherwise he loses the right, and the fixture becomes part of the realty. If I annex a fixture to the land of another with his consent, I am at liberty to remove it at any time.

Church pews are real estate in some parts of this country, while in others they are personal property.

Real Estate implies soil itself, houses, trees, etc.; and these are classed as lands. Then there are rights and interests and privileges which are called tenements; and lastly we have the broad sweeping term hereditaments, which signifies anything which may by law be inherited. These hereditaments are said to be *corporeal* when they are of a substantial or tangible nature, and *incorporeal* when they are not, or as a right issuing out of a thing corporeal, such as right of way, passage of water through the land of another, or of light, etc.

The interest that a man has in lands is called an estate, and the extent of that interest is indicated by the various names by which the different interests are designated. Thus, a fee simple implies an interest of unlimited duration, and allows of no qualification of any kind.

Feudum talliatum, Estate Tail, or Fee Tail, which means mutilated fee, are those conveyed with restrictions as to their alienation: thus, a man leaves his property by will to his son and the heirs of his body, or to the males in preference to the females of the family, and when the class or issue to whom it was conveyed becomes extinct, it reverts to the vendor. This class of estate does not now exist in the United States, it having been abolished by statutes in most, if not all, of the different States.

AN ESTATE FOR LIFE is next in the order of importance, because of its duration. It is regarded as a freehold, and includes estates held by tenants for their own or another's life.

LIFE ESTATES are created by deed, or devise, or by act of law, as in the case of dower and curtesy. An estate for the term of one's own life is a better one in the eye of the law than that for the life of another.

Estates conveyed to a woman for the term of her widowhood, or to man and wife during coverture, or so long as a man lives in a certain place, or so long as a man shall maintain his mill on the land, are life estates. A will which devises lands to G after the death of N, creates a life estate in N by implication, if G was the heir; but if not, the estate would go to the heir during the life of N.

A TENANT FOR LIFE may convey his interest in his estate by deed, or he may assign or under-let the whole or any part thereof.

A tenant may cut what wood is necessary for his present use, but if he cut for future use he will be guilty of waste; and if he cut timber, it must be used on the premises and not elsewhere. He cannot sell wood or timber, though needed for his comfort or support. Nor will a tenant be allowed to make brick out of his land for sale; that which does not prejudice the remainder or reversionary estate cannot be deemed waste.

The tenant has certain rights, as to emblements or profits of the crops, to compensate him for his labor; and, in case of his death, the same right inheres to his executors and administrators. These crops must be of annual planting and culture, such as corn, peas, beans, hemp, flax, saffron, melons, potatoes; these and other such annual crops are the subject of emblements. Clover and grasses are not, because they endure for more than one year. Trees raised by nurserymen are exceptions to this rule. The crop must have been planted during the life and occupancy of the tenant to entitle him to claim emblements. It is also essential to the claim of emblements that the tenant's estate be uncertain in its duration; for if a man knowingly plants a crop which he cannot gather before his tenancy expires, he virtually makes a present to his successor of his labor and pains.

The tenancy, if abandoned by the tenant, destroys his right to emblements, for it is essential to such a claim that the tenancy be ended by the act of God, as by death, or the act of the lessor in expelling him or terminating the lease.

A TENANT ON SUFFERANCE is not entitled to emblements; and a tenant's vendee of a growing crop has only his vendor's rights in the premises. So if a tenant sell his growing crop and then terminate his tenancy by his own act, his vendee will have no claim for emblements. The right of emblements carries with it the right to enter upon the land, cultivate the crop, if a growing one, cut and harvest it when fit, and if interfered with when in the simple exercise of these rights, by landlord or other, or if the crop be injured by them, the tenant may have an action for the same. Of course this is simply a right of ingress and egress for the purpose above stated, and not of exclusive right of possession. It is said that a mortgagee who forecloses takes the crop then growing, if the same were planted since the execution of the mortgage, free from any claim, no matter by whom planted.

THE LAW OF EMBLEMENTS depends greatly on customs and usages of different localities, and is generally regulated by statute.

The law allows the man who plants to secure the profits of his labor, but it says to him, "Thou shalt not waste," and it means that he shall not commit any act which would tend in any way to injure a lessee, or the value of the estate for those that come after him. If a man pull a house down it is waste; if he let it rot down for want of repairs it is not, at least an action will not lie for it; nevertheless, as the laws now stand, he is bound to keep it in repair.

QUESTIONS OF WASTE are determined upon the usage of the localities and the rules of good husbandry, and the party to whom the estate reverts immediately has the right of action for waste against the tenant; continued waste may be prevented by an injunction restraining the tenant from committing it.

There is another tenant of which we have to treat, viz., tenant by the curtesy. This estate is the interest to which the husband is entitled in the lands or tenements of his deceased wife, and is dependent on their having lawful issue born alive during the life of the wife which might have been capable of inheriting the estate; and it matters not whether the child be born before or after the property is acquired, the husband has curtesy in estates fee simple, estates tail, and trust estates; but any event which would have defeated or determined the estate of the wife if living, will, of course, put an end to the estate by curtesy, as a general rule.

THE HUSBAND'S INTEREST is subject to all incumbrances under which the wife holds the estate; and it is held that this interest is liable for his debts, and tenants by curtesy are, of course, subject to the duties, limitations, and obligations which apply to ordinary tenants for life. When the wife dies, the husband is at once tenant by curtesy, and has nothing to do to consummate his title.

Having now shown what the interest of the husband is in the wife's estate, we will turn the tables and see what the good-wife's rights are in her lord's estate; and as the laws of the different States vary in this respect, we will refer our gentle readers to the articles on married women in our abstract of the State Laws as to their rights, and which we commend to their careful perusal.

A FEW HINTS ON THE QUESTION OF DOWER may not be out of place, however. A wife has no dower in her husband's estate, if it is only for terms of years, no matter how long the term may be, or if it be renewable forever. Neither will she be allowed dower in real estate purchased by a firm of which her husband is a member, as long as the same is held for partnership purposes. Equity looks upon this class of property as like unto personalty. A husband may defeat dower by having an estate which he purchases conveyed to trustees for himself or his heirs.

The legal requisites of dower are, Legal Marriage, Seisin, and Death of Husband.

In cases where the husband acquires an estate as a means to accomplish an ulterior purpose, that is, he acts simply as the conduit through which the estate passes, without any intent to clothe him with any beneficial interest, it would give his wife right of dower. To illustrate: If A gets the money from B to buy an estate for C, and directly after acquirement, in pursuance of an agreement, makes a mortgage to B to secure the payment of purchase money, the wife has claim for dower subject to mortgage.

A WOMAN may bar her dower by elopement coupled with adultery in some States; but in others it requires a divorce in addition. Divorce will always bar dower if the woman be the party at fault, but not otherwise, because statutes in many States save her rights where she is the innocent party. She may also bar her dower by her own voluntary act or release, but generally the mere fact of her signing the husband's deed will not amount to a waiver of her right of dower unless it is so stipulated in the deed; although in some States a joint conveyance by husband and wife will bar the wife's right of dower.

It is probably too well known to mention here that when a mortgage given by the husband before marriage, or by husband and wife during coverture, is foreclosed, all right of dower is barred. But in some States the wife must be made a party to the proceeding, as she is not bound by those against the husband alone, as in the enforcement of a judgment lien outstanding at the time of marriage.

In some States a widow's right to dower is subject to liens of husband's creditors; it is also said that where the husband conveys land for public uses, as a town hall, or market house, or a street, that the right of dower is defeated; and as a general proposition, it is said that any provision, if agreed to, whether a chattel interest, land, or monetary obligations will, in equity, defeat a claim for dower.

The interests known in law as Curtesy and Dower relate to a period prior to the termination of coverture, for when coverture is at an end the interest is merged in the tenancy which then begins. Now, as to Estates during Coverture, perhaps it would be well to say that, when it is desired to convey an estate to a wife for her own use, and free from her husband's control, it is well to use the words "to her *sole* and *separate* use *forever*"; and when such intention is clearly expressed, equity will see that it is carried out.

WHERE AN ESTATE IS CONVEYED to A and B, husband and wife, and D, the husband and wife will take only one half, D will take the other; this is because the husband and wife are one; but, says the law, if estates descend to F, E, and G, they will each take one third, although F and E may be husband and wife.

Common law did not allow conveyances between husband and wife, so the lawyers invented the conveyance for *uses*, which, in many respects, resembles our deed of trusts, which are spoken of more in detail in our article on Deeds.

In the United States the husband is generally, but not always, required to join the wife in all conveyances of her real estate. Whatever a man may expend for the improvement of his wife's estate, the law will infer that it was done for the wife's benefit, and, therefore, the husband cannot recover for it unless otherwise provided by statute; and if the wife should die without issue, the poor husband has no claim on her estate as against her creditors or next of kin, except the right of emblements.

We will now pass on, in the words of the lecturer, to the consideration of estates for years, which our friend Blackstone defines as an interest in lands by virtue of a contract for possession of them for a definite and limited time. Thus, an estate for years may be for a number of *weeks*, or it may be for two thousand years; but the duration must be for a definite and limited period. This class of estate is usually brought about by a contract commonly known as a lease.

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LEASES.

THE ONE WHO LETS THE PREMISES IS THE LESSOR, AND HE WHO HIRES,THE LESSEE. A lease, like a summons, takes effect on delivery, and it must not contain what the law terms a Perpetuity, for a lease that contains a covenant that it may be renewed indefinitely at the option of the lessee is void at law. A lease to a clergyman for so long a time as he shall be pastor of St. Ann's, or so many years as he shall live, is not good, because of its uncertainty of duration and the impossibility of making it certain; but a lease to T. B. C. for twenty-one years, if he live so long, is good. A lease which reads "for one year," and so on from year to year, is deemed to be for two years; and so is a lease which reads "for years," without stating how many. Our grandfathers had ways of creating an estate for years by deed, by writing "not under seal," and by parole; but, since the adoption of the principle of the Statute of Frauds in this country, leases not in writing, or not signed by both parties, are deemed simply tenancies at will.

A LEASE MUST BE UNDER SEAL, if for a term of more than five years, as in Virginia and Kentucky; or if it exceed one year, in Vermont and Rhode Island. Seals in New Hampshire are not a requisite on a lease. Massachusetts requires all leases for over seven years to be under seal and recorded; otherwise they are not good against third parties, without notice. Ohio statutes simply require, for a lease exceeding three years, an acknowledgment, and two attesting witnesses; and nearly all the States have statutory provisions governing this matter.

ANY FORM OF EXPRESSION may be used which shows an intent on the part of the lessor to part with the estate in favor of the lessee, and an intention on the part of the lessee to accept the same for a certain period.

The words generally used, however, are, *grant* and *demise*, but they are not indispensable to the making of a valid lease; but it is an absolute necessity that the lease should set forth, in clear and unmistakable terms, just what premises are intended to be leased, for any mistake in this respect cannot be altered by parol evidence. There are many cases reported where parties who had no title to the premises at the time they gave a lease, but acquired title subsequently, have then tried to break the lease which they had given, because of their want of title at that time; but the law would not allow them to thus stultify themselves, or allow them the benefit of their own wrong. Nor in this case would the tenant or lessee be allowed to shirk any of the responsibilities which he had assumed under the lease, by claiming that the lessor's title was not good at the time of granting the lease. This arrangement is called Estoppel, and is applied only where the lease is under seal.

A lunatic, idiot, or infant cannot make a valid lease, although they may be lessees, because it is beneficial to them; for instance, the law would consider hiring a necessity in the case of a married infant ; or if a student hire a room while pursuing his studies, it would be deemed, under the circumstances, a necessity.

The law says that all covenants may be guarded by conditions; and most of the lessors in these days avail themselves of this privilege, so we will have to see how the law regards conditions in leases. As a general thing, the law favors such conditions as are annexed to estates for years more than those which only tend to defeat a freehold estate.

A condition not to underlet is not broken by an assignment of the entire term. So if you don't want your tenant to underlet nor assign his lease, you must say so in plain terms. If a man have a right to enter for conditions broken, he must, in order to avail himself of it, fulfil the requirements of the common law, unless otherwise ordered in lease, which are: —

First. If the condition is for non-payment of rent, a demand of rent precisely upon the day the rent is due and payable by lease, to save forfeiture; and it must be made before sunset, and upon the premises, and at the most public place thereon; that is, the front door is a better place in the eye of the law to make such demand than the basement door would be. The fact that there is no one at home does not relieve the party from making the demand. The rent is not due until the last minute of the natural day; therefore, if a tenant make a tender of his rent any time long enough to count the money before twelve at night he is safe, although the law says it should be made before sundown.

Acceptance of Rent is a waiver of condition broken. If Haskell let a house to Barnes, and Barnes breaks his lease by underletting to Hardon, if Haskell accepts the money or rent from Hardon, it will act as a waiver for that specific breach of condition, but no other, though it occur the next day; or where my tenant breaks conditions by cutting timber, if I accept rent I waive or condone this act, but not any subsequent act.

Now, having broken through the ice of "conditions," we find ourselves struggling in the waters of covenants, which, the law says, in a lease are either expressed or implied, or covenants in law or in deed.

An Implied Covenant is one which may arise by the construction of law from the use of certain words or expressions which have, by continued use in legal documents, come to mean an agreement, though not in express terms. Among these may be mentioned *grant*, *devise*, and the like, which imply a warranty against the lessor, an absolute covenant on the part of the lessor for the lessee's quiet enjoyment during the term.

Unless qualified by an express covenant, a lessor, in the absence of contract to the contrary, is not bound to make all necessary repairs, nor is he bound to compensate the lessee for any repairs he may make. But if a lessor agrees to make all the repairs necessary and fails to do so, it does not relieve the tenant from paying rent.

The words Yielding and Paying may imply that the lessee promises to pay rent, and if no time is stipulated for the payment of rent, it is payable at the end of the year. The acceptance of a lease obliges the lessee to use the premises in a proper manner.

Express Covenants bind a man, though he assigns his lease, and rent is accepted by the owner from the assignee, while with implied contracts the liability ends with the occupancy; if the express covenant in its terms is as beneficial to assignee as to lessee, it serves to release the lessee, but not otherwise. If a lessee assigns either a whole or a part of his estate for a part of the time, it is a sublease and not an assignment; but when, at any time, the lessee's whole remaining interest in the estate acquired by the original lease is transferred, it is an assignment.

A lease is always assignable unless it contains restrictions to the contrary. An assignment of a lease, in order to carry with it all rights, title, and privileges, must be under seal.

Assignments and Subletting sometimes bother even lawyers to know which is which. But Washburne lays down the infallible rule, that it is an assignment when the lessee parts with his entire interest; but if for a period which is to expire before the expiration of the original lease, then it is a subletting.

The formal Parts of a Lease when made as a deed, that is, under seal, are: First, the date, which will fix the commencement of the term, unless some other period is stated in the document itself; otherwise it will go into effect on delivery of the lease. Second, the full names of the parties. Third, some consideration for the contract, if nothing more than affection. Fourth, the description of the premises, which ought to be full and complete for all purposes of identification. Fifth, the *rights* and *liabilities* of the respective parties in relation to taxes, repairs, renewals, etc. Sixth, provision for *forfeiture*, in case of waste or non-payment of rent. (See Form.)

THE DUTIES OF THE LANDLORD AND THE TENANT will next occupy our attention; and as to the landlord, we may say he is in duty bound to see that his tenant has the quiet enjoyment of the premises, and is not disturbed by any one having a better title than the landlord.

The landlord will not render the tenant's occupancy uncomfortable by erecting a nuisance on or near the premises, or otherwise oblige him to quit the premises; and, in the absence of stipulation to the contrary, the landlord is bound to pay the taxes, ground rent, or interest on mortgage. But the landlord is not bound to make repairs, or allow the tenant for repairs which he may make, unless expressly agreed for.

The landlord has the right to enter upon the premises for the purpose of ascertaining whether there is any waste or injury done, after first giving notice of his intention. A landlord is not bound to rebuild a house which has been leased to another and burned down, but he can recover the rent for the unexpired term, unless otherwise stipulated in the lease.

TENANTS, in taking possession of premises, are entitled to use all the privileges, easements, and appurtenances to the estate, and all reasonable emblements that are attached thereto. He can maintain action against all who disturb him in possession or trespass on his lands. As a general rule, a tenant must take such care of his premises that others will not be injured thereby; and he is obligated to return the premises to his landlord at the end of his term undiminished in value by any wilful or negligent act of his.

The tenant is supposed to keep the premises wind and water tight, and make fair and reasonable repairs of all damages made or suffered by him. He is not bound to rebuild premises which have become ruinous during his occupancy, nor to put a roof on; neither is he required to do painting, or whitewashing, or papering, except when it is necessary to prevent decay.

A FARMER is in duty bound to keep the farm in a good and husbandmanlike manner, and preserve the timber and ornamental trees; otherwise he is liable for waste. The tenant is liable for all injuries suffered by strangers occasioned by his neglect to keep the premises in safe condition, as for having cellar-ways open, or coal-holes uncovered, or maintaining a nuisance and such like.

The chief office of the tenant is to pay rent, and if in possession without any agreement as to rent, he will only pay for his occupancy; but if under agreement to pay during the term, he will have to pay during the term, no matter how long it may be, even if the house burn down, or be blown up, except that he be obliged to move by lawful act of his landlord.

No violation of the tenant right, such as a sale of the premises by the landlord, will be permitted, for the sale must be made subject to the right of the tenant. Neither can a tenant shirk his responsibilities by substituting another tenant in his stead.

The relations of the landlord and tenant may be brought to a close in various ways; for instance, a tenancy for life ends with the life upon which it is contingent, and in all cases where the lease depends on a contingency, when it happens, the lease will terminate, and no notice to quit is necessary to dissolve the relations of landlord and tenant.

A TENANCY FROM YEAR TO YEAR can only be terminated by a notice to quit; said notice must be in writing and explicit, and require the tenant to remove from the premises. Personal service must be made. It must be signed by the person who has the right to immediate possession, and not by his agent. In some States the statute requires six months' notice, and some three months, and others but one.

The tenancy is also terminated by forfeiture for condition broken, such as waste, non-payment of rent, by merger, where the landlord marries the tenant, or the tenant buys the landlord's interest, or where the tenant surrenders his lease, or where the premises are taken by *right of eminent domain* for public use.

After the tenancy is ended the landlord has a right to possession, and if the tenant holds over, the proper and safest way for the landlord, as well as the cheapest, is to get the tenant out by due process of law, or by sealed lease to a third party, and not by any sharp, short, and sometimes very costly and undignified ways, now much in vogue by some miserly landlords.

Tenant is entitled to one week's notice of the termination of his tenancy if he hires by the week, or one month's notice when he pays by the month, and so on; and the landlord is entitled to the same notice from the tenant when he desires to end the tenancy.

FORM OF LEASE.

THIS INDENTURE, made the day of , in the year of our Lord *witnesseth*, that , of , in County, and State of , does hereby lease, demise, and let unto (*describe fully the premises intended to be leased*), to hold for the term years from this day of , the lessee yielding and paying therefor the rent of dollars, and said lessee promises to pay said rent in (*here insert times and amount of payments*), and to quit and deliver up the premises to the lessor , or attorney, peaceably and quietly, at the end of the term, in as good order and condition (reasonable use and wearing thereof, fire and other unavoidable casualties excepted) as the same now are, or may be put in by said lessor, and to pay rent as above stated, and all taxes and duties levied thereon during the said term, or for such further time as the said lessee may occupy the premises, and not make or suffer any waste thereof, nor lease, nor underlet, nor permit any other person to occupy or improve the same, nor make, nor allow to be made, any alteration therein, unless with the consent of the lessor, in writing, and that the lessor may enter said premises to view, or to make improvements, and to expel lessee for breach of any of the above conditions.

And provided, also, that in case the premises, or any part thereof, are destroyed by fire, or other unavoidable casualty, so that the same shall be unfit for use and habitation, then the rent above mentioned, or a just and proportionate part thereof, shall (according to the nature and extent of the injuries sustained) be suspended or abated until the premises shall have been put in proper condition for use and habitation by the said lessor, or these presents shall be determined thereby and ended at the election of the said lessee or legal representatives.

In witness whereof the said parties have hereunto interchangeably set their hands and seals the day and year first above written.

Signed, sealed, and delivered in the presence of
.... [L.S.]
.... [L.S.]
.... [L.S.]

SHORT FORM.

THIS INDENTURE, made this day of , 18 , by and between John Doe, of Sagadahoc, Wayne County, Ohio, and Richard Roe, of Kalamazoo, Michigan,

Witnesseth, that the said Doe, in consideration of the covenants of the said Roe, hereinafter set forth, does, by these presents, lease unto the said Roe the following-described premises, viz : (*Description.*)

To have and to hold to the said Roe from the fourth day of July, 1880, to the third day of July, 1885; and the said Roe, in consideration of the leasing of the premises as set forth above, covenants and agrees with the said Doe to pay, as rent for the same, the sum of $, payable at and by (*state terms and times*); and the said Roe further covenants with the said Doe that, at the expiration of the time mentioned in this indenture, he will peaceably deliver up the said premises in as good condition as they now are (the usual wear and casualties or loss by fire excepted); and that upon non-payment of said rent, or any portion thereof, when the same is due, the said Doe may distrain for rent due, or declare this lease at an end, and recover possession as if the same was held by forcible detainer; and the said Roe hereby waives any right to notice of such election or any demand for possession of the said premises.

The covenants herein contained shall extend to and be binding on the heirs, executors, and administrators of the parties to this lease.

In witness whereof we have hereunto set our hands and seals.

JOHN DOE. [L. S.]
RICHARD ROE. [L. S.]

NOTICE TO QUIT FROM A LESSEE UNDER A WRITTEN LEASE.

ANNAPOLIS, MD., March 19, 1882.

TO WILLIAM ARBUCKLE:

You will please take notice that Uriah Heep, the owner of the premises now occupied by you, viz. (*here insert a description of the premises by which they can be identified*), has executed and delivered to me a written lease of said premises for the term of one year from the date hereof. As I desire to take possession of the premises, you will please vacate them without delay.

MARTIN CHUZZLEWIT.

NOTICE TO QUIT FOR NON-PAYMENT OF RENT.

PROVIDENCE, R. I., March 19, 1882.

TO JOHN PARKHURST:

Your rent being in arrear, you are hereby notified to quit and deliver up in (*insert here the time allowed by law*) from this date, the premises now held by you as my tenant, namely: (*here describe premises to be vacated.*) Hereof fail not, or I shall take due course of law to eject you from the same.

FRANCIS LAVERY.

NOTICE TO TERMINATE TENANCY AT WILL.

JULY 1, 1882.

TO OBADIAH CATHCART:

It being my intention to terminate your tenancy, you are hereby notified to quit and deliver up, at the expiration of that month of your tenancy which shall begin next after this date, the premises now held by you as my tenant, namely: (*describe premises to be vacated.*) Hereof fail not, or I shall take due course of law to eject you from the same.

HENRY WARK.

MORTGAGES

GOOD old Chancellor Kent defines a mortgage to be a conveyance of an estate by way of pledge for the security of a debt, and which becomes void on payment of it; and they may be either equitable or legal.

AN EQUITABLE MORTGAGE signifies that the legal requirements to constitute a mortgage have not been complied with, yet there is an agreement between the parties that the debtor shall have a lien on the premises for his debt, which equity will recognize and enforce: thus, A deposits the deeds of his estate with B as security for the purchase money. Such mortgages, although recognized in this country, are of very rare occurrence, for now all mortgages are drawn with great care and recorded for public inspection.

MORTGAGES USUALLY, in these days, contain a power of sale for or upon breach of conditions; and also the equity and redemption clause. The grantor of the mortgage is called the mortgagor, and the one to whom the mortgage is given is called the mortgagee. An equity of redemption is a right which the mortgagor has to regain his estate by performing the condition of the mortgage *after* the time set for the same in the terms of the deed; and it is enforcible at equity and not at law.

THE TIME FOR REDEMPTION is limited by statute to three years generally. The heirs, assigns, devisees, administrators, and executors of the mortgagor may also have the right of redemption; so also have the subsequent mortgagee or encumbrancer; but nothing short of paying the whole debt gives the right to redeem, for a mortgagee is not bound to take his money on instalments.

Holders of equal equities are bound to contribute to the one who paid the mortgage debt for which all were holden.

Foreclosing may result from occupation by the mortgagee for twenty years, or a period necessary to bar a writ of entry, or by bill of foreclosure to obtain possession, which is common to the practice in England as well as in some of our States. A time is generally allowed for redemption before the decree is made absolute: by bill to obtain a decretal order of sale; by entry and possession for a term of years fixed by law; by a sale under a power of attorney for the purpose inserted in the original conveyance.

MORTGAGES OF REAL ESTATE are made in precisely the same form as a *warranty deed*, except that immediately following the warranty clause the following words are added: PROVIDED, NEVERTHELESS, that if said N M, his heirs, executors or administrators, shall pay unto the said grantee, his heirs, executors, administrators, or assigns, the sum of   dollars in   years from date of these presents with interest on said sum at the rate of   per cent per annum, payable semi-annually, and until such payment shall pay all all taxes and assessments to whomsoever laid or assessed, keep the buildings standing on the lands aforesaid *insured* against fire, in a sum not less than   dollars for the benefit of said *grantee*, his executors, administrators, or assigns, at such insurance office as they shall approve, and shall not commit or suffer any strip or waste of the granted premises, or any breach of covenant herein contained, then this deed, as also a certain promissory note having even date herewith, signed by the said N M, and whereby the said N M promises to pay said grantee the said sum and interest at the times aforesaid, shall both be absolutely void, otherwise shall remain in full force.

Sometimes the following is added: *And provided* further, that until default of payment of the said sum and interest, or other default, as herein provided, the mortgagee shall have no right to enter and take possession of the premises.

A Power of Sale is created by the following words, viz.: "*But upon any default* in the performance of the foregoing conditions, the grantee,   executors, administrators, or assigns, may sell the granted premises or any part thereof, together with all the improvements that may be thereon, at public auction in said   , first publishing a notice of the time and place once each week for three successive weeks in some one newspaper in said   , and may convey the same by proper deed to the purchaser absolutely and in fee simple, and such sale shall be a perpetual and complete bar in law or equity against me, and all persons claiming under me. And out of the money arising from such sale the grantee or his representatives shall be entitled to retain such sums as are secured by this deed, whether the same be then due or not, including all expenses incurred or sustained by reason of any default on the part of the grantor or his representatives to perform all the conditions of the deed, rendering any surplus there may be to the grantor or his heirs or assigns; and it is agreed that the grantee or his executors, administrators, or assigns, or any person in their behalf, may purchase at any such sale made as aforesaid, and that no other purchaser shall be answerable for the application of the purchase money, and that, until default in the performance of the conditions of this deed   or   heirs and assigns may hold and enjoy the granted premises and receive all the rents and profits thereof."

There are many brief forms of mortgages, but we believe the foregoing are the best for all purposes, and where the wording is not just what is wanted, any man who knows what he wants can insert it, or strike out that which does not suit.

Mortgage deeds are subject to the same requirements, as to recording and acknowledgment, as any other deed.

For mortgages of personal property, see Bill of Sale.

For assignments, see that title.

A Mortgage Note is usually worded thus:—

Dubuque, Iowa.

I promise to pay to William S. Smith the sum of $1,000, with interest at the rate of six (6) per cent per annum, in three years from date hereof, for value received.

This note is secured by a mortgage of real estate of even date herewith, and recorded in the   office of the county of   , State of

(Signature)   ....

Deeds and Wills.

ALL deeds should contain the *full names* of the parties thereto, a statement of the *consideration* for the conveyance; then a *description* in full of the property. Next in order comes the *Habendum clause*, and it is written thus: "*To have* and *to hold*," etc. It is to define the estate whether for *years*, *life*, or *forever;* and when the grantor desires to reserve something to himself rising or issuing out of the thing granted, but not the thing itself or a part thereof, we insert a *reddendum clause*, which opens by saying "*Saving* and *excepting*"; and a most accurate description of the thing reserved should be given and insisted on.

All *conditions*, if there be any, for the defeat, extension, or commencement of an estate follow, as the *right* of *redemption* in a mortgage, or the *use* clause in a trust deed, etc.; and these conditions should be stated as clearly as words will allow: *don't leave any room for imagination.* Then insert the *warranty* clause, which reads "And I *will*, and my executors and administrators shall *warrant* and *defend*," etc. Then comes the *testimonium* clause, commencing "*In witness whereof*," etc., the date, signature, and seals (when required), then the *signature* of *witness* (when requisite), and, finally, the acknowledgment, or proof, as it is sometimes called.

In the form annexed we have these several divisions of a deed set forth, and the reader is referred to the same for a specific amplification of the above remarks:

This is the accepted form in Massachusetts, and will do for nearly, if not all, the States, with very slight alterations, which will be noticed hereafter.

WARRANTY DEED.

Know all Men by these Presents, That of in County, State of , in consideration of dollars, to me paid by of in County, State of , the receipt whereof is hereby acknowledged, do by these presents give, grant, bargain, sell, and convey unto said , heirs and assigns, a certain parcel of land situate in in County and State of bounded and described as follows, viz.: (*insert here a full and complete description of the premises to be conveyed*).

TO HAVE AND TO HOLD the above-granted premises, together with all the privileges and appurtenances thereto belonging, unto the said , heirs and assigns, and to their own use and behoof forever.

And I, the said , for myself, my heirs, executors, and administrators, do covenant with said that I am lawfully seized in fee simple of the above-granted premises, and that they are free from all incumbrances (*if any, here state them, commencing with the words "Saving and excepting"*); that I have good right to sell and convey the same as aforesaid; and that I will, and my heirs, executors, and administrators shall, WARRANT AND DEFEND the same to the said grantee, heirs and assigns, forever against the lawful demands of all persons. (*If wife is to release dower, insert form of release hereto annexed.*)

In *witness whereof* have hereunto set hand and seal this the day of 18

Signed and sealed in the presence of

....
.... [L. S.]
.... [L. S.]

SUFFOLK, SS. BOSTON, Jan. 18, 1882.

The above-named personally appeared before me and acknowledged the foregoing instrument to be free act and deed.

HORACE GRAY,
Justice of the Peace.

WIFE'S RELEASE OF DOWER.

AND for the consideration aforesaid I ...., wife of ...., do hereby release unto said grantee, and .... heirs and assigns, all right of, or to both, dower and homestead in said premises. In witness whereof we have hereunto set our hands and seals this the .... day of ...., 18...

Where the wife joins with the husband in the conveyance as "I, John Smith and Hannah Smith, wife of said John," this clause is deemed unnecessary sometimes, but it is always safe to use it.

For husband's release of curtesy, the same form as the dower release is used by substituting the words "*husband*" for "*wife*," and "*curtesy*" for "*dower*," where they occur.

The learned Chancellor Kent says in his famous Commentaries that the following form of deed will convey an absolute title in any part of the United States; and his statement is sustained by all courts that have been called to pass upon it.

FORM.

I, JOHN BULL, in consideration of.............dollars to me paid by J. Crapaud, do bargain and sell to J. Crapaud (his heirs and assigns) the lot of land (*description*), etc.

Witness my hand and seal this ... . day of .... 18...

.... [L. S.]

Nearly all the States have a short form of deed. In Virginia or Texas this form would answer:—

(*name*) doth bargain, sell, and grant unto (*name*) all (*describe estate to be conveyed*).

Witness the following signature and seal.

... . [L. S.]

Or the still briefer deed of Indiana:—

.... conveys and warrants to .... (*herein give discription of premises*) for the sum of ....

Witness my hand and seal this .... day of........ ....

.... [L. S.]

But wise men deem it better to have as formal and full a statement of their title in a deed as possible. It may appear to be all nonsense to the shallow minded, but it is most always economical to have things done right at the beginning, and the more care that is taken in the conveying of property, the less liability there will be for future lawsuits.

QUITCLAIM deeds differ from warranty deeds in their wording as follows: 1. The words *remise, release, and forever* QUITCLAIM are substituted for *give, grant, bargain, sell,* and *convey*. 2. And in the incumbrance clause, after the word "incumbrances," the following is added: "made or suffered by *me*." (*Here state what mortgages or other incumbrances there are on the estate if any.*) 3. In the warranty clause, after the words "demands of all persons," add "*claiming by or through or under me, but against none others.*"

A shorter form may be used, however, as herein: "THIS CONVEYANCE MADE THIS day of , A. D. by and wife, County, in the State of , quitclaims to of in the county , State of , for the sum of dollars, all the following described real estate situated in the county of , State of , viz.: (*insert description.*)

Witness the grantors' hands and seals the day and year first above written.

J. A. B. [L. S.]
M. A. B. [L. S.]

TRUST DEEDS are made for the specific purpose of creating a trust in one party for the benefit of another, as in the case of a father giving property to his daughter on the eve of her marriage, which he desires to be free from her husband's interference and control; or perhaps she might be extravagant, and to save it from herself he would deed the property to one or more friends in trust for the daughter's use, under such restrictions as he might see fit to impose.

SHORT FORM OF TRUST DEED.

Know all Men by these Presents, That I, Alexander Stevens, of Steuben, county of Miami, Ohio, do hereby convey and fully warrant unto Charles Carrol, of Carrollton, county of Chesapeake, Maryland, and William Lambert, Philadelphia, county of Schuylkill, Pennsylvania, in consideration of dollars to me paid by the said Stevens and Carrol, the following described real estate situated in (*full description to be inserted here*), to have and to hold the said granted premises in trust, nevertheless, for the following purposes, to wit: (*here insert in a full and complete manner the purposes of the trust.*)

In witness whereof the said parties hereunto set their hands and seals this day of , A. D.

.... [L. S.]
.... [L. S.]
.... [L. S.]

Witness: ....

WILLS.

A person, in order to make a valid will, must be of sound mind; that is, he must know what he is doing, and the consequences of his act, as well as his liability to his children, who his heirs are, and the probable amount of his property. He must also be able to form a rational judgment.

Eccentricity will not invalidate a will, neither does *delusion*, if confined to a particular portion of a will; but if it affects the disposition of the property, it invalidates the whole. A person under guardianship cannot make a valid will.

Undue influence is (as a rule) that which destroys the free agency of the testator; and the instrument is the will of another, and not that of the testator. If a wife coax her husband to leave her his property, it is not undue influence; but if the testator is teased and bothered to death's door, a will made under these circumstances would be invalid, if it could be shown that he would have done otherwise but for the undue influence exerted.

Wills are either written or nuncupative (*i. e.*, oral). A will, when written entirely by the testator, is called a Holographic Will. A will written in chalk or pencil will be as good as if in ink; and it may be written on anything; and no particular form of words is necessary, save that the intent to make a will is expressed clearly; and, in fact, all the terms of a will should be so clear that no mistake will be made as to the intentions of testator. A will may be either certain or conditional.

Signatures. — A will must be signed by a testator, or by some one in his presence, and by his direction. Wills need not be *subscribed*, unless statute requires it; that is, a man need not sign his name at the bottom of a will; if he put it on the paper anywhere, as a signature, it will do. A man may make a valid will and yet sign an assumed name, or he may make his mark, although he be capable of writing. A testator must sign in the presence of witnesses, and they must see him perform the act, or some one for him, by his direction and in his presence.

Seals. — Generally speaking, seals are not necessary, though there are a few States that still require them. A will made on Sunday is valid.

Witnesses. — Too great care in selecting witnesses to a will is almost impossible; they should be as good as can be had; for if there is a contest over the will, your witness cannot be any too good. A poor witness is an abomination. You can have as many witnesses as you please, provided you have as many as the statute requires, for no less will answer. Sailors' and seamen's wills require no witnesses, but a nuncupative will does. Witnesses must sign after the testator (whom they must see when he signs), and the will must be completed when they sign; and they must sign their own names, or put their mark on, in the presence of the testator, and generally of each other.

REVOCATION.

A will may be revoked by burning, tearing, or destroying it, with intent to revoke, or by making a new will, which is signed and executed in due form. It requires the same ability and capacity in a person to revoke a will that it does to make it. Revocations caused by insanity, undue influence, or fraud are void. Oral evidence is admissible, to show intent in some cases. A revocation by destruction can only be made by the testator, or by some one in his presence acting under his direct and positive instructions. A will may be revoked by burning, but it is not necessary that the whole instrument should be burnt, or that the testator's signature should be obliterated; if the *animus revocandi*, or intention to revoke, be made manifest, it is revoked. Revocation is also attained by tearing the will; and if *any part of the will* be torn by the testator, with intent to revoke the same, the effect of the will is destroyed; but if the testator tears by accident or mistake, without *animus revocandi*, then the will is good.

Cancellation will revoke a will, whether the same be in whole or part. Writing on a will "this is annulled," or "no longer valid," destroys the will, provided, of course, it be done by the testator with that intention.

Wills may be revoked by codicils, or a new will, both of which must be executed with *precisely the same formality as the original will.*

If a man make a will and then revoke it by making another will, without destroying the first, and then he revokes the second, the first instrument will become good.

Marriage, after making a will, works a revocation of the instrument in most of the States.

If a child can prove that he was probably forgotten by his father in his will, his claim for a share will be good; but if his father left him a dollar, it would bar such a claim; or if it can be proved that the father intended to disinherit the son.

PROOF.—The burden of, as to the competency of testator, is on the executor; and if witnesses are dead, and there are no suspicious circumstances, oral evidence is admissible, to prove handwriting. This may also obtain where witnesses are too far away. Ordinarily, the law will assume that a man is dead when a will is presented for probate; but if called on, the executor must prove the death of testator: the possibility of death is not sufficient; but if a man is absent for seven years, the law will infer that he is dead, and act accordingly, but if he returns, all transactions under the will are rendered void thereby. The contestants of a will, in order to break it, must show that the instrument was extorted, or made under undue influence.

CONSTRUCTION.—The wishes of a testator will be carried into effect as expressed in his will if possible, provided they do not conflict with some positive rule of law: *e. g.*, a man will not be allowed to lock up his estate in order that his great-great-grandson may be the richest man in the State, for that is against public policy. No devise is valid if it is to vest at some future event which cannot happen within twenty-one years and nine months after death of some one living at time of testator. This rule will not apply to charitable bequests of a public nature. Conditions in restraint of marriages are void. If you leave property to your son and his heirs, and he dies before you, his children would have no claim on your estate under that clause in the event of your death. A minor cannot act as an executor, and if appointed, the Court will appoint an administrator in his stead.

An "administrator with will annexed" is one who is appointed to act in the place of an executor named in a will, who is either unwilling or incompetent to act.

Although the law says that any man *may* make a will, it by no means follows that he *can*. The lamented Longfellow was a man of great intelligence and culture. He could write an unlimited number of beautiful poems, but when he stepped from the fields of poesy into the cold, harsh atmosphere of the legal science and tried his hand at making a will, he failed. He felt that he was capable; but he erred for want of that knowledge which poor law students have to labor hard for years to attain. Mr. Longfellow made a will which would no doubt have been good if he had let it alone; but he changed his mind relative to some legacies contained therein, and he struck them out and inserted others in red ink; and the law says this was a revocation of the will by cancellation, as we have already seen. What Mr. Longfellow should have done was to have either made a new will or a codicil to the old one, and with the formality relative to witnesses and signature required by statute.

The following form of will commends itself for its simplicity as well as for its conformity to the requirements of the law:—

Be it remembered that I, , of , in the State of , being of sound mind and memory, but being well aware of the uncertainty of this life, do make this my LAST WILL AND TESTAMENT:

After the payments of my just debts and funeral expenses, I bequeath and devise as follows: (*here state just what you wish to be done or omitted, and use words which will admit of but one construction among ordinary men.*)

IN TESTIMONY WHEREOF, I hereunto set my hand, and in the presence of three witnesses declare this to be my last will, this day of , 18 .

On this day of , A. D. of signed the foregoing instrument in our presence, and declared it to be last will; and as *witness thereof*, we three do now, at request, in presence, and in the presence of each other, hereto subscribe our names.

....

....

....

ALABAMA. — *Deeds* must be witnessed, or else acknowledged and recorded. If they purport on their face to be sealed instruments, they have such force.

Wills must be in writing, attested by two witnesses in presence of testator.

ARKANSAS. — *Deeds* must be executed in the presence of, or acknowledged before, two witnesses, and must be recorded and acknowledged before some officer duly qualified.

Wills. Testator must be twenty-one years of age at least. It must be acknowledged and subscribed by testator in the presence of two witnesses, who must also sign *by his request.*

CALIFORNIA. — *Deeds* must be acknowledged, or proved and recorded.

A *will* must be subscribed by testator or some person in his presence, and the same must be acknowledged before two attesting witnesses, who must sign at the testator's request.

COLORADO. — *Deeds* must be acknowledged and recorded. Witnesses not necessary, and a scroll answers for a seal.

Wills must be attested in the presence of testator by two witnesses, and signed by him or some one at his request.

CONNECTICUT. — *Deeds* must be signed, sealed, and acknowledged by grantor, witnessed by two persons, and recorded in the town or city where land is situated.

Wills must be signed by testator, and attested by three witnesses, who must all be present and sign in each other's presence at one and the same time.

DELAWARE. — *Deeds* require only one witness and must be acknowledged and recorded. A scroll answers for a seal.

Wills must be attested by two witnesses and signed by the testator.

FLORIDA. — *Deeds* must be recorded within six months after execution, and must be acknowledged before an officer duly qualified, sealed and delivered in the presence of two witnesses. A scroll serves for a seal.

Wills must be attested and subscribed by three witnesses in presence of testator, and must be signed by latter, or some one in his or her presence. Nuncupative wills must be proven by three witnesses.

GEORGIA. — *Deeds* must be recorded within one year, and duly acknowledged; also signed and sealed by the grantor, and attested by two witnesses. A scroll serves for a seal.

Wills must be attested and subscribed by three witnesses; also signed by the testator or some person in his presence, at his request. Persons of fourteen years of age may make a will.

ILLINOIS. — *Deeds* must be duly acknowledged and recorded. Witnesses are not necessary. A scroll serves for a seal.

Wills must be attested by two witnesses, and signed by the testator or some one in his presence. Witnesses must see testator or his representative sign, and they must subscribe in his presence.

INDIANA. — *Deeds* must be duly signed, acknowledged, and recorded. No seals or scrolls are required.

Wills must be attested and subscribed by two witnesses, and signed by the testator, or some one in his presence, at his request.

IOWA. — *Deeds* must be duly acknowledged before a proper officer, and recorded. Witnesses or seals not necessary.

Wills must be signed by the testator, or some one in his presence, at his request, and witnessed by two persons. Nuncupative wills attested by two witnesses will convey property to the amount of $300.

KANSAS. — *Deeds* must be duly acknowledged and recorded, and signed by the grantor, or some one authorized by him. No seals required.

Wills must be attested by two witnesses, and signed by the testator, or some one in his presence; and the same acknowledged in the presence of the subscribing witnesses who saw him sign.

KENTUCKY. — *Deeds* must be properly acknowledged and recorded. No seals necessary.

Wills must be signed by the testator or some one for him, and in the presence of two witnesses, who must also sign at one and the same time.

LOUISIANA. — *Deeds* must be acknowledged and attested by the proper officer, and two others, and must be recorded. No seals required.

Wills are of three kinds. 1. Mystic, or sealed. 2. Nuncupative, or open. 3. Holographic. In a mystic will, the testator must sign the document, and have it acknowledged before a notary public and seven witnesses, by whom it must be signed. Nuncupative testaments are of two kinds, viz., by public act and by private act. In the former, the will is written by notary at testator's dictation, and acknowledged in the presence of at least three witnesses. In the latter, the testator either writes the will or has it written from his dictation, in the presence of five non-resident witnesses. He and they must sign it, and have it acknowledged before a notary. Holographic wills are written and signed by the testator himself.

MAINE. — *Deeds* must be duly recorded, and acknowledged, signed, and sealed by the grantor. Scroll will answer for a seal.

Wills must be signed by the testator or some one in his presence, and subscribed by three disinterested witnesses.

MARYLAND. — *Deeds* must be duly acknowledged and recorded, and require one witness. They also must be signed and sealed. A scroll serves for a seal.

Wills must be subscribed by three witnesses, and signed by the testator, or some one in his presence, and at his request.

MASSACHUSETTS. — *Deeds* must be duly acknowledged, recorded, signed, and sealed by the grantor, or some one duly authorized by him. Witnesses not required. Scroll will not answer for a seal.

Wills must be attested and subscribed by three witnesses, in presence of each other and the testator, and signed by the testator or some one in his presence, at his request.

MICHIGAN. — *Deeds* must be duly acknowledged and recorded; also signed and sealed, and witnessed by two persons.

Wills must be signed by the testator, or some one in his presence, at his request, and attested and subscribed in testator's presence by two witnesses.

MINNESOTA. — *Deeds* must be duly acknowledged and recorded, and witnessed by two persons. A scroll serves for a seal.

Wills are governed by the same laws as in Michigan.

MISSISSIPPI. — *Deeds* must be duly acknowledged, sealed, and recorded. One witness is necessary to the proving of the deed, and two if there be no acknowledgment. A scroll serves for a seal.

Wills if not holographic must be attested by three witnesses in presence of the testator, where real estate is devised; and by only one witness, if personal property be devised.

MISSOURI. — *Deeds* must be signed, sealed, acknowledged, and duly recorded. Witnesses not required. A scroll is sufficient for a seal.

Wills must be attested by two witnesses, and signed by the testator, or some one in his presence.

NEBRASKA. — *Deeds* must be acknowledged or proved, and duly recorded. They must be signed by grantor and one witness, in presence of each other.

Wills must be signed by the testator, or some one in his presence, at his request, and attested and subscribed in testator's presence by two witnesses.

NEVADA. — *Deeds* must be duly recorded, signed, and acknowledged. Witnesses are not required. A scroll serves for a seal.

Wills must be signed by the testator, or some one in his presence, and sealed; also subscribed and attested by two witnesses.

NEW HAMPSHIRE. — *Deeds* must be duly recorded, signed, and sealed, and attested by two witnesses. Scrolls will not suffice for a seal.

Wills must be attested and subscribed by three witnesses, and signed and sealed by the testator, or some one in his presence.

NEW JERSEY. — *Deeds* must be duly recorded, signed, sealed, and acknowledged. A scroll serves for a seal. Witnesses are not necessary.

Wills must be signed by the testator, or some one in his presence, and subscribed and attested by two witnesses, who must have the testator's acknowledgment of the will, and sign in his and each other's presence.

NEW YORK. — *Deeds* must be duly recorded and acknowledged; also subscribed and sealed. One witness must attest it, if not acknowledged previous to delivery.

Wills must be signed by the testator and two witnesses in the presence of one another. Witnesses must add their place of business.

NORTH CAROLINA. — *Deeds* must be duly recorded within two years, and acknowledged by one witness. A scroll serves for a seal.

Wills must be signed by the testator, or some one in his presence; also by two disinterested witnesses. Holographic wills are allowed, if testator's signature be proved by three witnesses.

OHIO. — *Deeds* must be duly acknowledged; also signed and sealed in the presence of two witnesses. A scroll answers for a seal.

Wills must be signed and acknowledged by the testator, or by some person in his presence and by his direction, and in the presence of two witnesses, and attested by them.

OREGON. — *Deeds* must be duly recorded, signed, sealed, and acknowledged. It is necessary to have two witnesses. A scroll serves for a seal

Wills must be signed by the testator, or some one in his presence; also by two witnesses at the same time.

PENNSYLVANIA. — *Deeds* must be duly recorded, sealed, and acknowledged. One witness is necessary, and a scroll serves for a seal.

Wills must be signed by two witnesses; also by the testator, or some one in his presence.

RHODE ISLAND. — *Deeds* must be duly acknowledged and recorded; also signed, sealed, and delivered. Scrolls will not serve for seals.

Wills must be signed by two witnesses, in the presence of the testator, and also by the latter, or some one for him.

SOUTH CAROLINA. — *Deeds* must be duly recorded, acknowledged, signed, and sealed. Two witnesses are required, and a scroll serves for a seal.

Wills must be signed by the testator and three witnesses in his presence.

TENNESSEE. — *Deeds* must be duly registered, and acknowledged by grantor, or by two witnesses. Seals are not necessary.

Wills must be attested and signed by two witnesses, and also by the testator, or some one in his presence. Holographic wills are allowed, if testator's signature is proved by three witnesses.

TEXAS. — *Deeds* must be duly recorded and acknowledged, or proved by two witnesses; also signed and sealed. A scroll serves for a seal.

Wills must be signed by the testator, or some one authorized by him, and must be attested by two witnesses, if not holographic.

VERMONT. — *Deeds* must be duly recorded and acknowledged in city or town where property is situated; also signed and sealed in the presence of two witnesses; scroll not sufficient.

Wills must be signed by the testator or some one authorized by him; also by three witnesses in testator's presence.

VIRGINIA. — *Deeds* must be recorded within sixty days; also signed and sealed by the vendor. A scroll answers for a seal.

Wills must be attested by two witnesses, in presence of each other, and of testator, unless holographic, and must be signed by testator, or some one by him authorized.

WEST VIRGINIA. — *Deeds* must be duly recorded, and acknowledged or proved by two witnesses, and must be under seal, or scroll will answer.

Wills, unless holographic, must be signed by testator and two witnesses in presence of one another; otherwise they must be signed by testator, or some one for him.

WISCONSIN. — *Deeds* must be duly recorded and acknowledged; they must also be signed and sealed in the presence of two witnesses. Scroll will serve for seal.

Wills must be attested and signed by two witnesses; also signed by the testator, or some one in his presence.

CONTRACTS

STATUTE OF FRAUDS.

THIS celebrated statute was passed in the reign of Charles II. of England, A. D. 1677, "for the prevention of many fraudulent practices which are commonly endeavored to be upheld by perjury and subornation of perjury," by requiring that certain contracts shall be in writing. As the provisions of this statute are wise and beneficent, the leading principles of the same have become a part of our law, but each State has its own way of applying these. The only portions of the statute which we shall notice here are those relating to contracts, because of their vital import to all; and we begin with the fourth section, which reads as follows: —

(1) " . . . No action shall be brought whereby to charge any executor or administrator upon any special promise to answer damages out of his own estate; (2) or whereby to charge the defendant upon any special promise to answer for the debt, default, or miscarriages of another person; (3) or to charge any person upon any agreement made upon consideration of marriage; (4) or upon any contract or sale of lands, tenements, or hereditaments, or any interest in or concerning them; (5) or upon any agreement that is not to be performed within the space of one year from the making thereof; (6) *unless the agreement upon which such action shall be brought, or some memorandum or note thereof, shall be in writing and signed by the party to be charged therewith, or some other person thereunto by him lawfully authorized.*

Section 17 reads thus: —

"No contract for the sale of any goods, wares, and merchandises, for the price of ten pounds sterling or upwards, shall be allowed to be good, except the buyer shall accept part of the goods so sold, and actually receive the same, or give something in earnest to bind the bargain, or in part of payment, or that some note or memorandum in writing of the said bargain be made and signed by the parties to be charged by such contract, or their agents thereunto lawfully authorized."

Under the head of REAL PROPERTY, EXECUTORS AND ADMINISTRATORS, we have stated the law as contained in this statute in regard thereto, and now will explain the doctrine of contracting to pay another's debts: *e. g.*, Abram and Isaac go into Shylock's store. Isaac wants to buy, and Abram says to Shylock, He 's good; if he don't pay you, I will: that promise is worthless unless in writing; but if Abram says, Give Isaac what he wants, and I will settle the bill, that is a contract with Abram and need not be in writing; and if the goods are sold on credit, the charge should be made to Abram, and not to Isaac; and in this kind of transactions always charge the goods to the one you hold to be the responsible party, for whoever you may open the account with the law will deem your debtor.

AGREEMENTS FOR OVER A YEAR.

ANY contract that *can* be performed *within* one year need not be in writing, for the statute relates only to those that are "NOT TO BE."

In Section 17, the words "ten pounds sterling" are changed in this country to fifty dollars; although in some of our States the figure is placed at a less sum. The statute says the agreement "must be in writing," but the best authorities in our country say that this agreement *should*, though it need not, contain all the terms of the agreement; nor need it be all on one piece of paper, for a connected series of letters may be sufficient. And the signature can be placed anywhere on the paper, bottom or top, unless the State law expressly requires that the agreement shall be *subscribed*, for in that case it must be signed at the bottom. The phrase *goods, wares, and merchandises* means *all kinds* of personal chattels according to our law, which, in this respect, differs from original statute. (See Fixtures.)

The statute does not mean that such contracts made contrary to these provisions are illegal, but simply that they shall not be upheld in a court of justice, nor pleaded therein for any purpose; and such contract will not be enforced in either law or equity.

LAW OF CONTRACTS.

A CONTRACT has been defined as an agreement between competent persons, upon sufficient consideration, to do or not to do a particular thing; and this definition is accepted as the best of the many that are known to the profession. The word *contract* is made to cover the terms *agreement* and *obligation*, and by some, though not correctly, the term *covenant*.

There are various kinds of contracts. The *simple contract* is known in law as the *parol* contract, and is applied to that class of contracts which are not under seal.

Specialties are that class of contracts which are under seal, such as deeds and bonds.

Contract of record means a judgment or public record.

Verbal contracts are simple contracts. This term should not be confounded with oral contracts; because a written contract may be a verbal one, inasmuch as "verbal" simply means "expressed in words." An oral contract is of course a simple contract.

An *express contract*, as contradistinguished from an implied contract, is one in which the terms and conditions of the bargain or agreement are openly stated or avowed at the time; as to pay a certain sum for a house, or a coat, or to deliver a stated amount of goods at an agreed price, or one in which the parties in positive terms state what is to be done or omitted.

An *implied contract* is one in which the law presumes, and justice and reason dictate, that every man contracts to perform. Thus, if I employ a man to perform a certain service, or order goods sent to my house, the law will imply that I understood or contracted to pay the value of the goods or service. The implied contract does not stop here, for the law, by its love of justice and equity, annexes it to every species of bargain, contract, or agreement, for the purpose of punishing neglect, for the law says that for my failure to complete my contract I shall pay to the other party or parties such damages as he or they may have sustained by such neglect or refusal.

The essential qualities of a contract are, — assent to *all* its terms by the parties thereto; a good and valid consideration (and this, in the majority of cases, must be proven); that the subject matter of the contract is not in violation of the law either by omission or commission. Contracts must be free from fraud. Some contracts require a seal and consideration; those for over one year require to be in writing.

In construing the meaning of a contract the law will always look to the intention of the parties; and as some writers put it, the intent is the "pole star of construction." The law will never place a forced construction on words, but will consider carefully the situation of the parties, and the matter of the contract in finding the probable meaning of the words used, for it is said that neither false English nor bad Latin will invalidate a contract. Words will receive their usual and common meaning, unless there be evidence to show that they are used in a technical sense.

PARTIES. — Having now spoken of contracts, in a general way, and of their essential qualities and construction, it would be well, perhaps, before proceeding, to consider the aforesaid in detail, — to say something of the parties who may, or may not, make a valid and binding contract. An idiot could n't make a contract if he would; and it is the same with the insane, or with an infant, notwithstanding the fact that said infant may be twenty years old (exclusive of the marriage contract); or the infant, if a girl, after she becomes a married woman, except as provided by statute; and the drunkard is often unable to make a legal contract. As to incapacity of infants, it is well known that every one who has not reached the age of twenty-one is a minor, or, as the law has it, an infant, and as such has not sufficient discretion to contract an obligation. Julius Cæsar was an infant till he was twenty-five, for the Roman law thus set the time.

The law takes no notice of a portion of a day; so that if I were born on the 2d of May, the law would assume that I was of age on the first day of May, in my twenty-first year; so that if I ordered a new suit on that day, I could not afterwards avoid the contract, by pleading that I was a baby at that time; or if I died on that day and made a will, the same would be as good as though I were fifty years of age. If I enter into a contract with an infant I am bound by it, but the infant is not; and if he wants to be dishonest, he can refuse to complete his part of the contract. Perhaps as good a way as any to cure the young fraud of taking advantage of the "Baby Act," is to force him to prove his infancy in a court of justice. It is a safe statement to say that an infant can undo anything that he has done, or promised to do, in the line of agreement, except for necessaries, and the law will uphold him in it. But the infant is liable for all torts that he may be guilty of, such as slander, trespass, conversion, etc. If by falsely representing himself to be of age, he obtains goods, the vendor can take the goods from him, and prosecute him for obtaining goods under false pretences, in some of the States.

If an infant, after he becomes of age, promises to complete his contract, he will be held as bound to fulfil the agreement; but a part payment will not be sufficient, as that will be only an acknowledgment of the debt.

For all necessaries for his own, his wife, or his children's maintenance, the infant is liable, as he likewise is (during coverture) for his wife's debts, contracted before marriage.

In determining what are and what are not necessaries, the infant's station in life must be considered; what would be considered necessary for the child of a justice of the Supreme Court might, in good judgment, be considered as luxury for the child of a laboring man, and hence not necessary.

Food, clothing, shelter, medical attendance, and instruction are necessaries; but before supplying the infant, inquiry should be made by the parties as to whether his lawful guardians are not willing to supply his wants; if they are, others should not, unless willing to do it gratis.

Never take a note from an infant for anything, for it is not worth the paper it is written on; for, while you could enforce a claim for necessities supplied him, yet if you take a note for the claim, you lose your right to sue for goods sold, and have to rely on the express promise contained in the note, which the law says is void. In this case the *implied* promise is a great deal better than the *expressed*, for the reasons above stated.

Idiots and lunatics are, in the words of the legist, *non compos mentis;* or, in other words, are not capable or competent of making a good and valid contract, except for the necessaries of life, and those made during what is termed a lucid interval.

A contract made by a man while drunk is *voidable*, except the same be for necessaries for himself or family; or, if the contract be not for necessaries, yet if the drunkard use the articles as his own after he becomes sober, it will be held that he affirmed the contract.

Law of Place.—A contract that is valid in the place where it is made is valid everywhere; and void, if void where made; but conveyances of real estate are subject to the law of the place wherein it is situated. A contract made in one place to be executed in another is governed by the law of the latter place, unless stated otherwise in the agreement.

CONSIDERATION.

CONSIDERATION is an inducement or motive for making a contract; and it is the very life of all contracts not under seal, both at law and equity. Promises without consideration are called nude pacts; and they embrace that class of gratuitous undertakings and promises which are binding in honor, but not in law.

The word *good*, as applied to consideration in a legal sense, is only used as to deeds, for simple contracts are not supported by natural affection or love; but for deeds, a valuable consideration is necessary, such as marriage or money, etc. A good consideration makes an instrument good as between parties, but a valuable one makes it good against subsequent purchasers.

Consideration may be for benefits received or promised, or for loss or inconvenience, or for obligations assumed for promisor, or for forbearance to stop litigation. A new promise by a debtor to pay a bill already outlawed is good consideration. Moral obligations are sometimes good considerations, but not always. A *seal* signifies consideration, and its maker is stopped from denying it; it is also evidence of deliberation, caution, and fulness of assent. In some States it is permissible to prove want of consideration in a sealed document, but in most States the rule is otherwise. The waiver of a legal or equitable right at the request of another is good consideration; so is forbearance to prosecute, for a reasonable time, a lawful or doubtful claim, but not one utterly void. The laws favor the settlement of disputes, hence the prevention of litigation as an agreement to submit disputes to arbitration is good. Mutual promises, when made at the same time, as promises to marry, are good, as are also services rendered or to be rendered.

Illegal consideration is that by which the laws of decency, morality, and public policy are violated. Consideration founded on natural or physical impossibilities is void; so also are contracts where *any part* of the consideration is void.

However slight the benefit to the promisor, if of any legal value, and however slight the damage, loss, or inconvenience to the promisee, if of any legal estimation, it is sufficient to support a contract.

MORAL OBLIGATION.

IF I promise to pay a witness more than his fees, or if you promise to pay for expenses incurred in the care of your sick adult son, or if the son promise to pay for the father's support, it is an express promise, but it will not bind, because the original consideration or moral duty is not a good consideration upon which to maintain an action. But if a man promises to pay a debt which he incurred during infancy, or to pay a debt barred by statute, it will be held good.

Mutual promises made at the same time are good, but not otherwise, because if made at different times they would be without consideration. Merely gratuitous promises are void. Natural affection is not sufficient consideration to support a promise. Gratuitous services stand on the same plane. If I pay another's debt without authority, I have my pains for my trouble. If I agree to pay $500, and sign a subscription paper to that effect, and in consequence of my act the minister orders work done or incurs expense, I am liable, though of no pecuniary benefit to me.

ASSENT.

ASSENT may be oral, written, or symbolical, but it must be *free*, *mutual*, *concurrent*, and *reciprocal*. The Deaf and Dumb contract in writing or symbolical language. So also in many cases sales at auction are almost wholly symbolical, as a nod from the bidder and a blow from the auctioneer's hammer give evidence of proposition and acceptance as plainly as though set forth in the most beautiful legal phraseology. If I make a proposition to buy or sell, or to do a thing for a certain consideration, I have an unquestioned right to withdraw my offer any time before its acceptance by the party to whom it was made. Perhaps the best illustration of this would be: if a man were to bid on a desk at an auction, he would have a right to withdraw that bid any time before the hammer fell. All offers must be accepted at once, in order to hold the party offering, unless longer time is specified, or the distance between parties requires it. The acceptance will date from the time it was made known to the party offering; and it must in all cases agree *exactly* in terms with the offer, or it will not bind the party offering.

Assent to be of any use in a contract must be free, and not be produced by violence or terror; but if I tell you I will "take it out of your hide," meaning thereby to inform you that unless the assent is given I will inflict corporal punishment, it will not amount to duress in the eye of the law; but if I cut your ear off and threaten to disembowel you, and you, relying on my veracity, believe that I will, and thereby are in fear of your life, that will amount to duress; and so it would be if I kept you locked up. Usually duress to another will not render a contract void; the only exception is where a fellow's wife is held in duress. In this case the law says again that man and wife are one, and if the husband makes an obligation to release the wife, it is void. They say this does not extend to any other relatives.

Assent must be obtained without fraud, for as one drop of muddy water would discolor a pitcherful of clear water, so will a taint of fraud render the whole contract unsightly and unclean in the eye of the law. If I am selling goods I am allowed to indulge in selling talk, because you are not supposed to believe all that I say in regard to the amount I am losing, or what I paid for the article, or the great offers that Gen. Grant made for the same article. Sensible people are apt to look on such talk with suspicion; and you are assumed to be sensible until the contrary is proven.

But on the other hand, if I am aware that there are defects in the goods, I am bound to tell you; and if I don't the sale is void, because I obtain your assent by fraud.

When I accept an offer of goods and direct as to how they shall be sent, and they are sent in accordance with my contract and are lost, I will be the loser; but if the price or condition on which the goods were sold to me is altered in any way, then I am not liable, because I have not assented to the new contract.

If I write to you saying I will sell you one hundred dozen albums for $5,000, you are entitled to a reasonable time in which to reply. I have the privilege of withdrawing at any time before acceptance, but the withdrawal takes place when you are notified of it; but if you have mailed your letter accepting my offer before my letter withdrawing offer is received by you, then I am bound, and a proposition which is made by letter cannot be rescinded by telegraph or *vice versa*. In accepting a proposition by letter or telegram it is absolutely necessary, in order to constitute a valid contract, that the terms of the original proposition should be repeated *verbatim*.

IMPLIED PROMISES.

IF a man undertakes to perform any trust, office, or employment, the law does presume a promise on his part to perform his undertaking with integrity, diligence, and skill, and he is liable for any damage to his employer by want of either of these.

If an agent contracts in the name of a principal, he says by implication that he has the authority of that principal; and if he has not, he is liable on such implied contract.

The law imposes certain duties on every man, which have no moral antecedents, and for the purpose of enforcing these duties the law implies a contract or promise; as, for example, the law requires a man to pay taxes, and if he fails to comply, a suit is brought to collect the same, and the law implies a promise to pay the collector. So towns and cities are obliged to take care of their poor. If a pauper having a settlement in Gardiner is relieved by the city of Boston, the law will assume that Gardiner promised to reimburse Boston.

Metcalf says that the only true ground upon which an action on an implied contract can be maintained is that of justice, duty, and moral obligation. It should be borne in mind that an implied promise or a promise in law will not be raised where there is an express promise, except where both parties have departed from the agreement, or where the contract is void, or where a party performs his work not according to his contract, but in a poor manner, and for that reason cannot sue on his express contract. The law will assume a promise on the part of the party benefited to pay what the work is worth (or a *quantum meruit*).

Where there is no legal duty imposed on a party which is of greater power than his own will, the law never implies a promise against his express declaration to the contrary. But if a man by his cruelty drives his wife or minor children from home, and he warns the public that he will not be responsible for their debts, the declaration is of no avail against the claim of those who supply them with the necessities of life. The case would be different if the wife or children left the house against the desire of the husband and without just cause.

Actions speak louder than words. If I see a man at work on my land, and I allow him to continue, I am bound to pay him the fair value of his services; but if I know nothing about it, and don't see the man, I am not liable, though I receive material benefit from such work, because the law allows me the right to hire or reject, and if I am not allowed that opportunity I am not bound. If I paint your house, and before I get through it burns down, you will have to pay for what I did; and so with all mechanics.

CONSTRUCTION.

IF a contract has a particular intent, which, if carried out, would defeat the general intent, or if the particular intent cannot be carried out, then the courts will so construe the words as to give effect to the general intent.

If words have a legal meaning, usage cannot alter that meaning, unless so stipulated in the deed. Technical words are always construed according to their technical meaning, except as in case of want of knowledge by the buyer; or a release of *all demands*, where a particular demand is receipted for, will simply apply to that specific demand; but if there be nothing to indicate from all the circumstances that a general release was not meant, then it will be good.

The whole contract must be considered, in order to ascertain the meaning of its parts, and every part must be given due effect, if possible, unless clearly repugnant to the evident intentions of the parties. If the contract fails to express the evident intention of the parties, the intent will outweigh the expression. A man will not be allowed to profit by his own wrong.

VOID.—If a person contracts to do some particular act, the impossibility occasioned by inevitable accident will not release him; but if the parties to the contract knew that the promise was absurd or impossible, the contract is void. Unjust or unconscionable bargains will not be enforced.

All contracts to indemnify persons for doing illegal acts, or to pay a witness to avoid giving evidence, or contracts to procure by sinister means an act of the Legislature, are void. Contracts to pay a third person to bring about a marriage are void; so are contracts which have a tendency to restrain marriage; for instance, marriage conditions annexed to a will which restrains marriage are generally void.

If a contract is only partly void, and it is capable of being divided, the good part will stand.

A note given on Sunday for antecedent debt is good, or a debt paid and retained by creditor on Sunday is good. Notes made on Sunday are valid in the hands of innocent parties. Gambling debts are generally unlawful by statute; and he who lends money to another to gamble cannot recover.

SALES.

SALE is a branch of contracts, and is an extension of one particular kind. A sale must be a proper and immediate transfer as distinguished from some future transfer or *contract for sale.* It is also to be distinguished from barter or exchange contracts, as in the latter the consideration, instead of being paid in money, as in case of sale, is paid in goods, etc. A sale, where made by the owner, is of course a voluntary one, and, when without conditions, is called absolute, and conveys all the former owner's title to the thing sold; but in cases of a sheriff's sale a buyer receives no warranty of good title, though he does in all ordinary cases of sale.

In order to constitute a valid sale at law, the thing to be sold must be in existence; parties must be competent, the seller must be the owner or his authorized agent; there must be a consideration or price. If a house be destroyed by fire, and the owner, while in ignorance of the fact, sells the same, the sale would be void, because the house was not in existence at the time of sale; but a man may sell what is partially in existence, as all the wool his sheep may produce in a season, or a growing crop, or all the milk from his cow for a certain time, or a calf which a cow may be carrying; but a man cannot sell what he does not own, unless by the owner's consent. So if you find my watch and sell it, I can retake it wherever I find it; and the same, of course, if it were stolen and then sold. But in the case of stolen notes sold before maturity, or government bonds which *are negotiable*, the thief himself conveys a good title to an *innocent purchaser* by the transfer, for the delivery of negotiable paper passes the title. But if I hold myself out as solvent when the reverse is true, and on the strength of these representations you sold me goods on credit, you would have a right to take them from me, but not from my vendees. Again, if you sold me goods supposing me to be a different person, no title would pass to me, nor could I give a valid title to any one and thereby defeat your right to retake your goods at any time. The law presumes that every sale is concluded at once, that is, that the bargain is made, the price paid, and the chattel delivered without delay; therefore, the mere offer to sell and another to buy, without delivery of the chattel or payment of price or part thereof as earnest, binds neither party. If, however, the offer is made and accepted to deliver goods in three months from date, or in such quantities and at such time as buyer may direct, it is binding as a contract for sale, which is really a species of conditional sales, and under that title will receive due attention.

PARTIES.—We have seen that guardians, trustees, assignees, and agents for sale could not become purchasers from themselves, or of the interests intrusted to them; and, generally, the competency of parties is therein set forth, therefore we will not enlarge on it here.

CONSIDERATION, or price paid, must be certain or capable of being made so; *e. g.*, a man sells me a safe, the price to be what any three dealers say it is worth; herein the price is not certain, but it may be made so; however, if the parties to whom the matter of price has been referred refuse to set a price, then the sale is void. The goods or article sold must be specific and susceptible of identification; *e. g.*, if I buy one hundred bushels of corn, that specific quantity of corn must be separated from the bulk before the sale is complete. A knitting of the contracting minds is necessary also to a valid sale; *i. e.*, there must be an agreement as to the terms of the sale, and as to the qualities of the goods, for an honest misunderstanding relative to any material fact will vitiate a sale. As before stated, the consideration of a sale is money; for anything else will be a trade, barter, or exchange.

DELIVERY.

IN all sales or contracts for the same, delivery is an important element; and it is a maxim of law that an actual or constructive delivery should follow a bargain, in order to complete a sale, otherwise it would be void as against third parties without notice; for instance, if I sell you my horse and you allow me to retain possession of it, and I afterwards sell it to a third party who knows nothing of our transaction, and he takes possession of the horse, your claim is worthless as against him. The mere fact of the seller retaining possession of a thing after sale is evidence of fraud. Constructive or symbolical delivery is made by a party giving a bill of lading, or a warehouseman's receipt, or by placing the buyer's mark on the property, or, in the case of a house, by giving the keys. When the buyer is to take the goods away, then the separating of the actual goods by measuring, weighing, etc., is a delivery. If the buyer designate a *certain time* or *place* for the delivery of the goods, or the *manner* in which they are to be sent, the seller is bound to carry out the instruction; if he does, the loss, if any, will fall on the buyer, but otherwise it would be the seller's loss.

The seller should notify the buyer if at a distance as to the way that he has sent the goods, in order that the buyer may protect himself by insuring, etc.

If a man buys a lot of goods and then refuses to take them when they are tendered, or neglects to perform his part of the agreement, he is liable, and the seller may sell the goods, and the original buyer will be liable for the deficiency in value, if any; the seller is likewise liable if he neglects to perform his part of the contract; but a man who has sold goods to a party who becomes insolvent immediately after need not deliver them unless he get his pay or security for the same.

In the absence of any instructions as to the place of delivery, the nature of the thing to be delivered must be taken into consideration, and the delivery made at the most appropriate place; or, in other words, what properly belongs in a man's shop or factory is not delivered if left at his house.

Delivery generally passes the title to property in the case of sales; but there are exceptions, as in the case of goods obtained under false pretences, or when they are sold under a misapprehension of facts, or when, by agreement of the parties, the title is not to vest in the buyer until the purchase money is fully paid.

If the chattel is sold on credit, and nothing is said relative to the possession or delivery of the same, the purchaser is entitled to the property and possession immediately, subject to the creditor's right of *stoppage in transitu*, of which more hereafter. No sale is complete and no property passes while anything remains to be done which will determine its quantity or price, unless the parties agree to the contrary. In cases where earnest money is paid, and the sale is not completed, and finally fails through the fault of the seller, the money must be paid back.

Conditional sales are those which are made subject to certain conditions, either as to quality, the time and place of delivery, or the payment of the purchase money, whether C. O. D. or on instalment; and this last class of sales constitutes the principal portion of what are called conditional. The purchaser of an article on the instalment plan agrees that the title to the property shall vest in the seller until the whole of the purchase money is paid, and that, for any breach of condition by the buyer, he may retake the property. This makes the purchaser a simple lessee; and this class of sales have come to be known as goods sold on lease, or leased property, and new laws are being enacted every year to protect the interests of both parties to such contracts; and in nearly all the States the taking or concealing of such property, with intent to defraud the seller, is punishable by fine or imprisonment.

Stoppage *in transitu*, or the right to stop goods while *in transit*, vests in the seller, when the goods are sold upon credit, and may be exercised where the buyer becomes insolvent before the goods are delivered, and before he has transferred his title, or any part thereof, to others. Notice should be given to the carrier, warehouseman, or whosoever has custody of the goods, that the right is to be exercised and that he is not to deliver them; of course, if they have been delivered to buyer, or are in his possession actually or constructively, the right to stop is defeated. But goods cannot be said to be in the buyer's possession if they are in a public warehouse and held there for payment of dues; nor are they in the buyer's possession, so as to defeat that right, though in custody of a carrier employed by the vendee, although in such a case the goods could be taken only on satisfaction of the carrier's lien for services. The buyer has possession of the goods if they are in the seller's store or warehouse on agreement to keep until a certain time for buyer's accommodation, and this is equally so whether storage is paid or not. In other words, the buyer has possession when a delivery has been made, whether the same be actual or symbolical. (See Delivery.)

WARRANTY.

IF a man sells an article he warrants the same as to his *title* and *right to sell.* This warranty may be either *expressed* in words or *implied* from the circumstance; for instance, if the thing is in the seller's possession, the warranty is implied; but if the article is not in possession of the seller, the sale is at the buyer's risk, in the absence of an express warranty. At common law the rule in regard to sales is, "Let the purchaser beware." He ought to exercise all his faculties in making a purchase and demand warranties for what he is in doubt of; but a general warranty will not cover obvious defects, although it may if the thing has a direct effect on the quality warranted and which the buyer could not ascertain at the time, or where the buyer is misled by the seller. Misrepresentation of any material fact will vitiate a sale, for it is a species of fraud. A warranty made after the sale is completed is of no earthly use, because there is no consideration to support it; therefore a warranty, to be binding, must be made before the completion of the sale. A man selling goods by sample warrants that the bulk of the goods will be the same in every respect. If a man expressly refuses to warrant an article, no warranty can be implied.

A horse is not sound if he have any ailment, whether curable or not, which interferes with his immediate usefulness. If a man sells an article "just as it is," or "with all its faults," he must not by *any* artifice prevent the buyer acquiring a full and complete knowledge of the condition of the chattel. Sales made pursuant to an order of a court, as a rule, give no title beyond the one vested in the person whose property is seized, and no warranty will be implied.

BREACH OF CONDITION.

A BUYER has a right to refuse to receive goods which are not precisely the same as he ordered or was led to expect by the seller that they would be, or he may return goods and bring a suit for breach of condition; but if the goods are kept, or any of them sold before the breach of condition is discovered, the value of the same will be deducted from any judgment recovered. The fact of a man's selling a part of the goods does not debar him from returning the balance when he discovers the failure of the goods to meet the requirement of the contract.

If goods are returned to the seller for breach of condition, and he refuses to take them, the buyer may sell them, and recover from his vendor the loss on the resale, as well as charges for storage and selling the same.

BILLS OF SALE.

NO particular form of words is necessary to constitute a bill of sale, and bill rendered by the merchant or tradesman, which reads,

Mr. T. J. MAHAN:
Bought of ENGLE & LARKIN, Booksellers, one Family Bible, at $20.00.
(Paid) *ENGLE & LARKIN.*

is just as good for all ordinary purposes as the more pretentious document which constitutes the legal bill of sale.

FORM OF BILL OF SALE.

Know all Men by these Presents, That I
in consideration of paid by the receipt
whereof is hereby acknowledged, do hereby grant, sell, transfer, and deliver unto the said
the following goods and chattels, viz.: (*here describe the goods.*)
To have and to hold all and singular the said goods and chattels to the said and
executors, administrators, and assigns to their own use and behoof forever, and hereby
covenant with the grantee that am the lawful owner of the said goods and chattels,
and that they are free from all incumbrances,
that have good right to sell the same as aforesaid, and that will
warrant and defend the same against the lawful claims and demands of all persons.

In witness whereof
the said hereunto set
hands and seals this day of A. D.

Signed, sealed and delivered in the presence of [L. S.]

To convert the above into a POWER OF SALE CHATTEL MORTGAGE insert between the paragraph ending with the phrase "demands of all persons" and the one commencing "In witness whereof," the following form:—

Provided, nevertheless, That the said mortgagor, or his executors or administrators, shall well and truly pay unto the said , or his executors, administrators, or assigns, the sum of ; then this deed, as also a certain promissory note, bearing even date herewith, signed by the said , whereby he promises to pay the said the said sum and interest at the time aforesaid, shall both be void, and otherwise they shall remain in full force and virtue.

And provided, also, That until default by the said , or his executors and administrators, in the performance of the condition aforesaid, or of some part thereof, it shall and may be lawful for him or them to keep possession of the said granted property, and to use and enjoy the same; but in case of such default, or if the same, or any part thereof, shall be attached at any time before payment, as aforesaid, by any other creditor or creditors of the said mortgagor, or if the said , his executors or administrators, shall attempt to sell the same, or any part thereof, without notice to the said , or his executors, administrators, or assigns, and without his or their assent to such sale, in writing expressed, or shall remove the same, or any part thereof, from the place where they now are, without such notice and assent, then it shall be lawful for the said , his executors, administrators, or assigns, to take immediate possession of the whole of said granted property, to his or their own use, and to sell and dispose of the whole, or so much of said property, at public auction, as shall produce a sum of money sufficient to pay and discharge the above-mentioned debt or liability, with interest, and all costs and charges of keeping and selling the same, and all just and equitable liens then existing thereon, without further notice or demand, except giving days' notice of the time and place of said sale to said , or his legal representatives; and after the said debt, or liability, with interest, costs, charges, and liens shall be so discharged and satisfied, the surplus of the money arising from said sale and the residue of said granted property shall be paid and restored to said , or his legal representatives, discharged from all claim under this mortgage.

MORTGAGE NOTE SECURED BY PERSONAL PROPERTY.

$1,000. JAN. 25, 1882.

For Value Received, I, Edward Gillis, of , promise to pay Alfred Frazer, the sum of one thousand (1,000) dollars $\frac{\quad}{100}$ in one year from this date with interest, to be paid monthly, at the rate of six (6) per cent per annum, during the said term, and for such further time as the said principal sum, or any part thereof shall remain unpaid.

Signed in the presence of
FRANCIS J. DOWD.

EDWARD GILLIS.

Secured by a mortgage of personal property in Dubuque, Iowa, to be recorded in (*here state proper place of record.*)

FORM OF NOTE USED BY LENDERS OF MONEY ON COLLATERAL SECURITY.

This form gives all the advantage to the lender, and a person is foolish who signs it.

$1500.75. NEW YORK, July 3, 1882.

I, William Micawber, for value received do promise to pay to A. Shylock, or order, the sum of fifteen hundred dollars $\frac{75}{100}$ and interest at the rate of two per cent per month for such further time as said principal sum or any part thereof shall remain unpaid. I having deposited with this obligation, as collateral security, namely: (*here state the full description of the articles pledged*,) with authority to sell the same without notice, either at public or private sale, or otherwise, at the option of the holder or holders hereof, on the non-performance of this promise, he or they giving me credit for any balance of the net proceeds of such sale remaining after paying all sums due from me to the said holder or holders, or to his or their order; and it is further agreed that the holder or holders hereof may purchase at said sale.

WILLIAM MICAWBER.

LEASE FOR ARTICLES SOLD ON INSTALMENTS.

(SHORT FORM.)

Know all Men by these Presents, That have received and hired of the following described articles, namely: *for the use of the above-mentioned articles*, and as rent for the same, have this day paid to the said the sum of dollars, and promise further to pay to and legal representatives the sum of dollars per (the first payment to be made on the day of ,), until such time as the sums so paid and to be paid by shall amount to the sum of dollars, at which time said rent shall cease, and the said articles become absolute property; but, in case of failure to pay said rent as aforesaid, the said may, without being deemed guilty of trespass or tort, and without thereby rendering sell liable to refund any sums received by as rent as aforesaid, enter any house or place where said articles may be, and take possession of and remove said articles therefrom, and further agree that so long as said rent shall be payable as aforesaid will not injure, sell, mortgage or relet the said articles, or remove the same from , and that in case of failure to pay the said rent will on demand return the said articles to the said or legal representatives.

Witness hand and seal this day of , A. D. .

Signed and sealed in the presence of

(Signatures)

BILLS, NOTES AND BONDS.

THE essential requisites in law to constitute a promissory note are the following: it must be in writing; the promise to pay must be absolutely expressed; it must be for the payment of money, and money only; and the amount must be fixed and certain, and payable without contingency at a fixed period of time, or upon some event which must certainly occur. If no time be fixed for its payment, it is payable upon demand; if made payable to a fictitious person, it is payable to the bearer. When there is no date, the time is computed from the day when its existence is first established. If the sum in figures differs from that in words, the latter controls.

The maker of a bill is called the *drawer;* and the one to whom it is directed, the *drawee.*

If the drawee accept the bill, he is known as the *acceptor;* and he who indorses a bill is the *indorsee;* and in case of a note, the person giving the note in the first instance is called the *maker*, and he to whom it is payable is called the *payee.*

An *indorsement* is the writing of the indorser's name on the back of a business paper; and it is said to be in *blank* when the indorser writes his name only on the back of a bill or note. A special or qualified indorsement is given by one who does not wish to bind himself, and it is done by adding the words *without recourse.*

The words "pay contents to W. H. C. only" is a restrictive indorsement. A *full indorsement* is one where the name of the *indorsee* is mentioned; thus, "pay to the order of J. G., Jr.," and for the reason that it necessitates the indorsement of the holder before transfer.

The words *I promise to pay* in a note signed by two or more persons is a *joint* as well as a *several* note, and the parties can be sued jointly or separately; and it is the best form. If the note reads *we jointly and severally promise to pay*, it is the same; but it is a joint note when it reads *we promise to pay*, or words to that effect.

Bills for acceptance must be presented by the holder or his representative, and at the residence or usual place of business of the *drawee.* The holder should make a fair effort to find the drawer if absent from his usual place of business and home; but if the bill is due, his absence is a refusal to pay, and the bill goes to protest. The bill should always be presented to the *drawee*, or to some one authorized to act for him; upon refusal, if the bill is addressed to another party, then present the bill to the other, for, in order to hold the drawers or indorsers, you must present it to each of the persons to whom it is addressed. The time for presentment is in business hours on business days.

Mutual notes exchanged are good; they are *business* and *not* accommodation notes. Accommodation notes are given without consideration, and to accommodate, as their name implies. They are not valid between parties, but they are in the hands of innocent holders without notice.

Negotiable paper is that which may be transferred so as to give valid title to holder; and such notes are made payable to a person "or bearer," "or order," or assigns, or to the cashier of a bank.

A material alteration in a note destroys its validity. Notes bear interest only when so stated therein.

Demand or sight notes draw no interest until after demand or presentation of the same has been made.

Demand bills and notes are not entitled to three days' grace, but bills and notes payable at a certain time are, and bills payable at or after sight as well.

In case of non-acceptance, the holder is to notify the drawer and indorsers of the fact without delay, and suit may be brought after notice of non-acceptance has been given.

Indorsers are entitled to immediate notice. Unreasonable delay will relieve them; and when the indorser receives notice, he should at once notify the drawer, or other indorser, to whom he means to resort for payment.

Notices are usually sent by mail. Notice to one party is notice to all, but not where parties live in the same town, or in a city where there is no penny-post.

Indorsers and acceptors guarantee the solvency of the party and the validity of the bill or note.

Lower Canada.— Bills of exchange, payable to order, are transferred by endorsement, which may be either in full or in blank. When endorsed in blank they become transferable by delivery. Bills payable to bearer are transferable by delivery either with or without endorsement.

PAYMENT.

A BILL or note must be presented on the day it is due (in order to hold indorsers), at the place appointed, or at the house or place of business of the maker or acceptor. In case of death, to his personal representative; in case of insolvency, to his legal representative. If the maker leaves the country, presentation at his last place of abode will hold indorser. So would a presentation at place of business, though the same be locked up, if in business hours; if he live in California, but has an office in Boston, presentation at the latter place would be sufficient, if payable in Boston. If, upon careful and diligent search, you are unable to find the maker of a note or acceptor of a bill, your legal rights are as secure as though you had presented the bill.

In the States of Maine, New Hampshire, Massachusetts, North Carolina, South Carolina, Alabama, Indiana, Kentucky, Wisconsin, Iowa, and Michigan, and the Dominion of Canada, three days' grace are allowed on bills of exchange, payable at sight, or future day, certain, and on all negotiable orders, drafts, and notes payable at future day, certain. Drafts, notes, and checks payable on demand are not allowed days of grace.

CHECKS AND DRAFTS.

A CHECK or draft is an order on a bank, directing the payment thereof to party named, or his assignee, on demand. When made payable to   , or bearer, it is payable to whoever presents it; but when payable to   , or order, it must be indorsed by the party in whose favor it is made, and is useless without.

BILLS AND NOTES.

THE peculiarities of bills and notes are, first, consideration; second, negotiability; third, days of grace.

Consideration is always presumed, except between immediate parties. The note carries on its face the fact that defendant ought to pay. No person can be permitted to give testimony to invalidate any instrument to which he has made himself a party by affixing his signature. If he has no interest in the event of the case on trial, the general rule of law is that he may.

The indorser or holder of a negotiable security has nothing to do with the transaction between the original parties.

A foreign bill would have to be protested a second time; probably an inland bill would not.

A person who simply delivers a note is not an indorser, either in law or fact. Delivery is warranty of his own title; he is liable in deceit for breach of his warranty; he also warrants the genuineness of all indorsers. The party to whom a note is delivered only can bring an action. A deliverer does not warrant solvency of parties. The rule of *caveat emptor* applies. An indorser's contract is conditional. He contracts to pay note at maturity if maker does not, after demand and notice has been given; but it is not a collateral agreement: he simply agrees to pay his own debt. Guarantor's contract is an agreement to pay debt of another, and must be in writing and be supported by a consideration. The English and Provincial rule is that document must show a consideration on its face. This rule obtains also in New York, Alabama, and Georgia. The original consideration, indicated by the words "value received," is enough. If no notice of dishonor is given and guarantor is prejudiced, he is released. A guaranty is not negotiable except when attached to bills, notes, or checks. It is then negotiable and passes title.

A surety's engagement must be in writing; it is collateral and within the statute of frauds.

Surety is treated exactly as a principal debtor, and can be sued at the same time if their contract is a joint one; if not, then the surety can be sued before the principal debtor, and said action needs no consideration to support it. A surety is entitled to all collaterals given to creditor to secure debt; if he pays, this is called *subrogation.*

If the creditor gives the collaterals to debtor, it will discharge the surety or indorser.

The holder has no right to give extra time to debtor, or to do anything detrimental to surety or indorser. If principal debtor is a minor, or otherwise disabled by law, it will not release surety.

If creditor releases one party and recovers from another, the latter may sue released party, who will call in former holder, who released him, and either will have to pay back the money.

Indorser cannot be released before maturity, as his liability has to be fixed by Demand, Notice, and Presentation. Maker or acceptor need not pay unless there has been presentment, demand, and notice. Presentment is a manual exhibition of the paper. It need not be presented when maker or indorser says he will not pay, or if you have note with you and describe it, and he does not ask to see it.

When banks have paper and send out notice before maturity, it is a demand and notice.

A holder of a paper may strike out all the indorsers he wishes. All he declares upon he must prove in case of suit.

A notary must act in his own name. Presentment and demand should be made on last day of grace. If demand is made before sunrise or after sunset, plaintiff is liable to lose his case; but if he tries during the day and fails to find, it is good. Demand must be made at a time convenient. Place of date of instrument is usually the place of presentment and demand, and, unless the place is stated, it devolves on defendant to show that it was payable at some other place. It is payable where executed.

Notice *follows* protest; presentment and demand *precede* it.

Notarial notice establishes plaintiff's case, but must do its whole work. Evidence to supply or change is not admissible. If there is no notary, evidence is admissible. Protest should show demand, notice, presentment, and refusal. Protests of inland bill or promissory notes do not have the same effect as foreign bills.

Notary's personal evidence is not admissible. Notice given on Sunday is good, although not required. Sealed notes are not negotiable, and attested witnessed notes are good for twenty years between the parties thereto, but are only the same as ordinary notes when in the hands of third parties.

Protests on notes and bills of exchange are made by *notaries public.*

BONDS.

A BOND is a promise under seal whereby the promisor acknowledges that he is held and firmly bound unto the promisee. The maker of the bond is called obligor, and the one to whom the bond runs the obligee, and the sum for which the maker is bound is called the penalty or penal sum, and this bond is called a penal bond, because it is an obligation to pay a sum of money in case of default or non-performance, etc. The condition clause of the bond is the all-important part of the instrument, because therein should be set forth the reason for its creation, and all in the fullest manner possible.

It should be borne in mind that an obligor on a bond is not liable to pay more than his obligee loses by reason of the default or defect which the bond is given to guard against.

FORM OF BOND.

Know all Men by these Presents, That I, John Williams, of Newark, in the State of New Jersey, am held and stand firmly bound unto R. Burlen, of Boston, in State of Massachusetts, in the sum of one thousand (1,000) dollars, to be paid to the said Robert Burlen or his executors, administrators, or assigns, to which payment I bind myself, my heirs, administrators, or executors, firmly by these presents.

The condition of this obligation is such that if James Parker faithfully and honestly performs all the duties incumbent upon him as a collector for the said Burlen, then this obligation shall be void; otherwise it shall remain and be in full force and virtue.

In witness whereof I have hereunto set my hand and seal this seventeenth day of March, A. D. 1882.

Signed and sealed in presence of [L. S.]

Agents and Attorneys.

AGENT is the name applied to all who do business for others, and under this head we shall also consider attorneys, as they properly belong to this class, the only difference being that one is the general name, while the term *attorney* is applied to a special class.

In regard to agents generally, the law says that their authority must be equal to the acts they have to perform; as, for instance, if they would convey real estate, they must have authority under seal so to do, save in one instance, that of a corporation who may by vote authorize their agent to contract by deed; but authority under seal is (with this exception) the only authority by which an agent can bind his principal on a sealed instrument.

Written instruments will authorize agent to bind principal in written agreements. Oral authority is sufficient for oral contracts, but the act must be the act of the principal, and not that of the agent, as in a deed by T S, the agent of M R, it should read M R, by his attorney T S, or M R, by T S. If an agent contracts in terms which will not bind the principal, or when he acts without due authority, he will sometimes lay himself liable.

A principal has a valid claim against a purchaser of goods from his agent (who did receive payment), even if he fails to disclose the fact of his agency. If, however, the buyer is led by the agent to believe that he is the owner of the goods, and there is nothing to dissipate, or beget a doubt in, the belief, then he may offset the claim of the principal by a claim due from the agent. So it is if Smith comes to my office and employs me to do a certain service in his own name, as agent for an unnamed party; although I afterwards discover that he is acting for Jones, my right to sue and recover my pay from Jones is good. But if I make Smith my debtor it would not; and if I charge the account to Smith, I ought to do so only as against him in his capacity as agent.

If a public agent pledges himself as security for a contract made in behalf of his government, then he is liable for the same, but not otherwise.

A principal may ratify the unauthorized act of his agent, but if the acts were under seal the ratification must be also. A subsequent ratification is equivalent to a prior command.

A general agent differs from a special agent in so much that the former is vested with general power to do his principal's business, while special instructions are given to the other. If a general agent exceed his authority his principal is liable; but a special agent, in order to bind his principal, must go according to instructions.

AGENCY.

D*EL CREDERE* is a term applied to a commission under which an agent guarantees to his principal the prompt payment of a debt, in consideration of an additional premium.

An agent is bound to keep exact accounts of his agency, and no matter how innocent may be the failure to keep accounts, carelessness in this respect is imputed to wilful negligence, and renders the agent liable; and, so far as concerns his claims for commission, his failure to keep proper accounts is fatal.

If an agent causes his principal any loss, the principal may offset such loss against the agent's claim for commission.

An *attorney* is a person who has delegated to him the authority of another. They are appointed under a special agency to perform a special act or deed; in a popular sense it includes all agents employed to do any business for another.

All persons of sufficient understanding may act as attorneys for others.

A *letter* or *power of attorney* is a form in writing by which one or more persons give to one or more persons the power to act for them in the performance of some lawful transaction.

Power of attorney is generally of two kinds, general and special. A general power gives the agent authority to act generally for the principal; a special power limits the agent to particular acts.

The power of attorney, when sealed, enables the agent to execute a sealed instrument for his principal; if the power be parol he cannot do so. Where the statute requires certain formalities for the execution of an instrument, similar formalities are requisite to give power to make that instrument. Parol powers may be either oral or written. An attorney acting under parol power may bind his principal by written contract, when the statute of frauds, as the foundation of an action, requires a writing signed by the parties sought to be charged. An agent by oral authority may sign the name of his principal without a seal.

Powers of attorney are always construed strictly, and when general terms are used in regard to a particular subject-matter, it is presumed they are used in subordination to that matter.

Under a special power limiting the authority, the principal is not bound by any act of the attorney in which he exceeded his authority.

Any person transacting business with an authority under a power of attorney of another should see that the authority given by the terms of the power is of sufficient scope, for the authority of an attorney is to be strictly construed.

Where a power is jointly vested in several persons, they should all join in executing it; and any condition prescribed in the execution of a power must be followed strictly.

When a power of attorney does not give authority to delegate it to another, the attorney cannot act by substitute.

A revocation of a power takes effect from the time it is communicated to agents and third persons. Insanity of attorney revokes the power; marriage also acts as revocation in case of power granted by a single woman.

In a simple power of attorney an agent must act only in the name of his principal; and in signing, the principal's name should be first written, followed by his own as attorney.

When the power given is to convey, or otherwise affect, any land, tenement, or hereditament, it is only necessary to have the power of attorney and substitution acknowledged, and the acknowledgment and filing for record in such cases are the same as a deed or mortgage.

The essentials of a power of attorney are: —

1. The names of the principal or principals, and of the attorney or attorneys, and the words of appointment.
2. The nature and description of the duty imposed, and the particular method of performance.
3. The character of the power imposed, whether it be general or limited, with conditions, limitations, restrictions, etc., if any.
4. The power of substitution and revocation.
5. The ratification or confirmation.
6. The signature of the principal or principals.
7. The proper attestation and acknowledgment, when required by law, as when the power is to convey or encumber real estate.
8. The recording, when required by law.

The following are the forms, which will be found all that is necessary in any case, of general and special powers of attorney: —

General Power of Attorney.

Know all Men by these Presents, That have constituted, ordained, and made, and in stead and place put, and by these presents do constitute, ordain, and make, and in stead and place put to be true, sufficient, and lawful attorn for and in name and stead, and to use, to ask, demand, levy, require, recover, and receive of and from all and every person or persons whomsoever the same shall or may concern, all and singular sum and sums of money, debts, goods, wares, merchandise, effects, and things whatsoever and wheresoever they shall and may be found due, owing, payable, belonging, and coming unto the constituent, by any ways and means whatsoever:

Giving and hereby granting unto said attorn full and whole strength, power, and authority in and about the premises; and to take and use all due means, course, and process in the law for the obtaining and recovering the same; and of recoveries and receipts thereof, and in name to make, seal, and execute due acquittance and discharge; and for the premises to appear, and the person of the constituent to represent before any governor, judges, justices, officers, and ministers of the law, whatsoever, in any court or courts of judicature, and there on behalf, to answer, defend, and reply unto all actions, causes, matters, and things whatsoever relating to the premises. Also, to submit any matter in dispute to arbitration or otherwise; with full power to make and substitute one or more attorneys under said attorn , and the same again at pleasure to revoke. And generally to say, do, act, transact, determine, accomplish, and finish all matters and things whatsoever relating to the premises as fully, amply, and effectually, to all intents and purposes, as the said constituent, if present, ought or might personally, although the matter should require more special authority than is herein comprised, the said constituent ratifying, allowing, and holding firm and valid all and whatsoever said attorn or substitutes shall lawfully do, or cause to be done, in and about the premises, by virtue of these presents.

In witness whereof, have hereunto set hand and seal this day of in the year of our Lord one thousand eight hundred and eighty- .

Signed, sealed, and delivered in presence of

Power of Attorney.

Know all Men by these Presents, That I, Thomas Faulkner, of San Jose, California, hereby constitute and appoint John J. Madden, of Montreal, Canada, to be my true and lawful attorney for me, and in my name and stead to (*here state the specific power to be given*), hereby granting unto him, said attorney, full power and authority, in my name and behalf, to sign, seal, acknowledge, and deliver any and all deeds, or other instruments in writing, which he may deem necessary or proper in the premises, and otherwise to act in and concerning the premises as fully and effectually as I might do if personally present.

In witness whereof I hereunto set my hand and seal the day of , A. D. 18 .

(Signature) THOMAS FAULKNER. [L. S.]

Signed and sealed in presence of
M. A. Hernan.

Mandate or Power of Attorney, Lower Canada.— The mandate may be either special for a particular business, or general, for all the affairs of the mandator; when general it includes only acts of administration. For the purpose of alienation and hypothecation, and for all acts of ownership, the mandate must be express. The mandatary can do nothing beyond the authority given or implied by the mandate. The mandatary is obliged to execute the mandate which he has accepted, and he is liable for damages resulting from his non-execution of it while his authority continues.

PARTNERSHIP.

WHEN parties combine their money, property, labor, or skill for the transaction of business for their common profit, they are said to have formed a partnership. This may be done by oral agreement or formal writings; but the party who enters into partnership without writings may, and probably will, live long enough to regret it.

The parties may agree as they please as to the loss or the profits; but in the absence of writings to prove the contrary, the law will assume that partners share profits and losses equally.

The law will not allow me to take one third of the profits, as profits, in a business carried on by two others in their own name, without holding me liable for one third loss, even if there is an agreement that I shall not be liable for any losses. If I hold myself out as a partner in a firm, and goods are sold by parties who rely on my statement, I am liable, whether I share in the profits or not. Or if I go shares with my brother in his profits as a member of a firm, I am liable for the debts.

Any partnership in a business contrary to the law of the land is void, and confers no rights except as to innocent parties. Each partner has an implied right to bind the concern for simple contracts made in behalf of the firm and within the general scope of the business. He may pledge or mortgage the stock; he may give due bills or notes; he may indorse notes and purchase goods and compromise claims, notwithstanding that the parties have agreed among themselves in writing or otherwise to the contrary. But a partnership cannot be held liable for the private debts of a partner.

If I lend a man money for his private use, and he gives me as security a note in the firm's name, and I know, or ought to know, from the various circumstances connected with the matter, that he is exceeding his authority, I cannot hold the firm liable.

A partner may compound or compromise a debt due the firm. Each partner is the agent of the firm; and if he should execute a sealed document, except releases, such as composition deeds in bankruptcy (unless done fraudulently), in the name of the firm and bind it, he must have authority under seal; yet if the other partners stand by and see him do it, and offer no objection, it will be held good, or they may ratify the act of the partner.

An ostensible partner is one whose name is published to the community as a partner, while a *nominal partner* is a partner in name only. A *dormant partner* is one of whom the world is supposed to know nothing; and when this supposition is correct, he is a *secret partner*, but he is liable with the others when found.

Real estate bought with partnership funds, and to be used for partnership purposes, will generally be dealt with the same as personal property of the firm, and equity will protect all the partners' interests therein, although it may stand in only one of their names. Nevertheless, an innocent purchaser from the partner holding title for good consideration cannot be disturbed in his possession, nor his title overthrown. If he has notice the case would be different.

Partners must act in unison in order to bind all, unless it be matters relating to minor affairs. Two members of a firm cannot conclusively bind a third; and if any partner is about to make a trade with *Doe* which I do not approve, if I express my dissent to *Doe*, the trade if completed will not bind me, provided I give notice in time to prevent *Doe* entering into it.

It is generally understood that one partner cannot sue another in law. This, however, is erroneous, for a partner may sue for a balance due him after a settlement of accounts, or for a balance from the settlement of some specific account. But in the majority of cases partners seek relief in equity, for that court can do what the law cannot, and has full jurisdiction over partners and their troubles, and metes out justice to all alike.

If Jones is a member of the firm of Smith & Jones, and also of the firm of Jones & Brown, it prevents either from suing the other in law, because Jones would be both plaintiff and defendant, which is not according to law; but equity will afford relief, and it will also enforce that which every man has a right to expect from the partner, viz., *good faith*. If my partner has the lease of our office, or interest or benefit properly belonging to the firm, transferred to him, he has his trouble for his pains, for equity will declare the contract void. Nor can he do anything which might tend to the detriment of the firm without laying himself liable. If I deal with one partner and believe him to be the sole owner of the goods, and pay him for them, the firm would have no valid claim against me.

Partnership creditors have a prior claim on the funds of the partnership, and the funds and property are bound in law to satisfy them first, and the creditors must apply partnership effects as far as they will go before they have a right to levy on the private estates of the partners; and equity will insist that claims of private creditors must be satisfied out of the private estate before partnership creditors. But in Massachusetts and New Hampshire it is possible for a firm creditor to get ahead of a private creditor, but not *vice versa*.

Death dissolves a partnership, and the surviving members of the firm become the trustees of the partnership property, but cannot make any contracts binding upon the remaining members of the firm, nor indorse notes or bills with the firm name, unless the ex-partners give the authority needed to sign for them. A parol authority is sufficient. The surviving members have the right, however, to settle the affairs of the late firm and wind up the business.

If a partnership be dissolved by mutual consent, I may pay either partner, if I do it in *good faith*, although one has been chosen with full powers to settle the business. The receipt or discharging of a bill by the other partner is a good release.

When a firm dissolves, the public must be given notice, if the partners would save themselves from further liability on account of the firm; and customers must receive actual notice.

Articles of Copartnership.

Articles of Agreement made this .... day of ...., in the year ......, by and between ....

The parties above named hereby agree to associate together as partners under the firm name of ...., for the purpose of carrying on the business of ...., said partnership to commence on the ... .. day of ...., and to continue for the term of .... And it is agreed by said parties that at all times during the continuance of the partnership they or each of them will give their attendance, and to the utmost of their skill and power exert themselves for their joint interest, profit, benefit, and advantage, and will truly employ, buy, sell, and merchandise with their joint stock and the increase thereof, in the business aforesaid; and also that they will at all times during the continuance of said partnership, bear, pay, and discharge equally between them all rents and other expenses that may be required for the support and management of the said business; and that all gains, profits, and increase that shall come or arise from or by means of their said business shall be divided between ...., and all loss that shall happen to their said joint business shall be borne and paid between them.

And it is further agreed that there shall be kept at all times full and correct books of account, wherein each of the said partners shall enter all matters and things whatsoever to the said business and the management thereof in any wise belonging; which said books shall be used in common between said partners, so that either of them may have access without any interruption or hindrance of the others. *And* said partners, once in . ..., or oftener if necessary, shall make and render each to the other a full, complete, and correct account of all profits and increase by them or either of them made, and of all losses by them or either of them sustained; and also all payments, receipts, disbursements, and all other things by them made, received, disbursed, acted, done, or suffered in their said partnership business, and upon the rendering of such accounts shall clear, adjust, pay, and deliver, each to the other, their just share of the profits so made as aforesaid. *And* the said parties further agree that during said partnership neither of them will indorse any note or otherwise become surety for any person or persons whomsoever without the consent of the other partners, and at the end of their partnership the said partners will make each to the other a full and correct account of all things relating to their said business, and in all things truly adjust the same, and all and every the stock and stocks, as well as the gains and increase thereof, which shall appear to be remaining, either in money, goods, wares, fixtures, debts, or otherwise, shall be divided between them.

In witness whereof the said parties hereto set their hands this .... day of ...., A. D. ....

(Signature.)

Form of Notice of Limited Partnership with Affidavit and Acknowledgment.

This is to certify, that the undersigned have, pursuant to the provisions of the statutes of the State of ...., formed a limited partnership, under the name or firm of ....; that the general nature of the business to be transacted is (*describe the business*), and that .... is the *general* partner and .... is the *special* partner, and that the said (*the special partner*) hath contributed the sum of .... dollars, as capital towards the common stock, and that the said partnership is to commence on the .... day of ...., and is to terminate on the .... day of .... 18..

Dated this .... day of .... one thousand eight hundred and

(Signatures.)

County of ....SS. On the .... day of ...., one thousand eight hundred and ...., personally appeared before me *the above-named parties, who acknowledged* the foregoing instrument to be their free act, and that they had executed the same.

County of .... SS. .... the general partner named in the above certificate, being duly sworn, doth depose and say, that the sum specified in the said certificate to have been contributed by the special partner to the common stock has been actually and in good faith paid in cash.

Sworn this .... day of .... 18.. before me.

Form of Notice of Dissolution of Partnership.

THE partnership heretofore existing under the name of M and R, wherein A B, of ... ., ... County, State of ...., and C D, of ...., ... County, State of ...., were general partners, and J S, of ...., ... County, State of ...., and J R, of ...., ... County, State of ...., were special partners, is, this .... day of ...., A. D.... dissolved by mutual consent.

A B.
C D.
J S.
J R.

The affairs of the firm will be adjusted by C D, at .... etc.

(Must be published in accordance with requirements of the statute.)

ASSIGNMENTS.

AN *assignment* is the transfer of the whole of any property, real or personal, in possession or in action, or of any estate or right therein; it is a transfer by writing as distinguished from one by delivery.

In our remarks on *leases* we have defined the difference between a lease and an *assignment*, therefore we will not allude to it further. All the property that man can have in this world, and all the rights, title, and privileges thereto belonging, are assignable, unless prohibited by statute; for instance: choses in action, such as bonds, notes, mortgages, leases, debt, and wages are assignable generally, although they were not at common law; but judges cannot assign their salaries, nor a pensioner the bounty granted him by government, nor a guardian his duties. Neither are personal trusts assignable. Properly speaking, a deed or bill of sale is an assignment, although the term is seldom if ever used nowadays, in connection with these instruments.

In the days of old an assignment had to be executed with as much formality as the instrument which was to be transferred; but in this utilitarian age we are prone to take the shortest cut across lots that we can find; hence, when we want to assign an instrument, we write across it the indorsement, "*I* [or *we*] hereby *assign*, *transfer*, and *set over* to Frederick Elsner all *my* [or *our*] right, title, and interest in and to the within document."

(Signatures.)

No set form of words is required; if the intention to create an assignment is evident, it will be so construed; and it is not deemed necessary to prove consideration unless specially attacked on that point, and then it will be well to be able to prove good consideration, even though it be unnecessary.

GENERAL FORM OF ASSIGNMENT.

Know all Men by these Presents, That I, , for value received, by these presents do assign, transfer, and set over unto [*name of the assignee and description of the things assigned*].

To have and to hold the same unto the said executors, administrators, and assigns, forever, to and for the use of hereby constituting and appointing my true and lawful attorney irrevocably, in my name, place, and stead, for the purposes aforesaid, to ask, demand, sue for, attach, levy, recover, and receive all such sums of money which now are, or may hereafter become due, owing and payable for, or on account of, all or any of the accounts, dues, debts, and demands above assigned giving and granting unto the said attorney full power and authority to do and perform all and every act and thing whatsoever requisite and necessary, as fully, to all intents and purposes, as might or could do if personally present, with full power of substitution and revocation, hereby ratifying and confirming all that the said attorney or substitute shall lawfully do or cause to be done by virtue hereof.

In witness whereof, I have hereunto set my hand and seal, the day of , one thousand eight hundred and

(Signature.) [L. S.]

Executed and delivered in the presence of

A *note* or check is assigned by the indorsement on its back, which is a warranty that the instrument is valid in every sense of the word.

Some assignments contain, for the purposes of their creation, a power of attorney, and perhaps the most common form of this class is the ASSIGNMENT OF WAGES, which runs as follows: —

Know all Men by these Presents, That I, , of , county of and State of , in consideration of dollars to me paid by , of , county of and State of , do hereby assign, transfer, and set over to the said all the claims and demands which I now have, or which I , at any time between the day of 18 , and the day of , 18 , may or shall have, against , for all sums of money due, or which may become due me, for services as [*insert occupation*]; and I hereby appoint and constitute said and his assigns to be my lawful attorney, irrevocably, to do and perform all acts, matters, and things in the premises, in like manner, and to all intents and purposes, as I could if personally present.

Witness my hand, this day of , 18

(Signature.)

As a general proposition it may be stated that all parties who are affected by the assignment should be given notice thereof, as in the case of a policy of insurance, or the assignment of dower, partnership property, and the like. In some cases assignments, in order to be good against third parties, must be recorded, as, for instance, an assignment of shares in a stock company, or a patent, or of a workman's wages.

RELEASES.

A RELEASE is the giving up or the abandoning a claim or right to the person against whom the claim exists, or the right is to be exercised or enforced, and is usually accompanied by a quitclaim deed. But in many cases a release may be created by the words: "*I hereby release* from all demands or claims of every name and nature which I may hold against him to the date hereof."

A mortgage is sometimes released by a quitclaim deed, but oftener by mortgagee simply writing an acknowledgment on the margin of the public record that the mortgage claim has been satisfied.

A release is a contract, and is governed by the laws thereof, and therefore requires good consideration.

A release from creditors to a debtor under a composition requires a seal for each creditor, and all releases relating to real estate are usually under seal. For a release from creditors to a debtor under a composition, the following form may be used: —

Know all Men by these Presents, That we, the undersigned creditors of , of , in consideration of the fact that he is not able to fully satisfy the several claims we hold against him, do hereby agree to accept the sum of in full payment and satisfaction of all the debts owing to us respectively at the date hereof by and from said [*name of debtor*] which is paid by or for [*name of debtor*] to [*names of parties receiving the money*] for the use of and the intent that the same may be divided amongst his creditors herein, in proportion and according to the debts to us severally due and owing; and, for the consideration aforesaid, each of us said creditors, for self and heirs, executors, or administrators, and copartners, doth by these presents remise, release, and forever discharge the said heirs, executors, or administrators, of and from our said several debts, and all manner of actions which we, the said creditors, may have, or which our legal representatives hereafter may, can, or ought to have, by reason of the said several and respective debts to us severally due and owing, for or by reason of any other matter, cause, or thing whatsoever, from the beginning of time.

In witness whereof we have hereunto set our hands and seals this, the day of , 18

(Names of creditors.) [L. S.]

RECEIPTS are a species of release, but, unlike releases, they are a simple acknowledgment of money received, and may be explained, controlled, or contradicted by evidence; but a release can only be so affected on the ground of fraud. If a party accept $10 in settlement of a claim of $1,000, and give a receipt for the same, he may recover the balance due, unless there is good reason for the deduction being made.

INSURANCE

INSURANCE is a species of contract whereby, for agreed premium, one party undertakes to insure another against loss on a specified subject by specified perils. A complete or full definition of insurance is out of the question in a work of this kind. A plain statement and explanation of the terms employed in, and the general laws governing, insurance is all our present plan admits of.

The party agreeing is called the insurer or underwriter; the other, the insured or assured. The consideration is called the premium. The events insured against are the risks or perils, and the subject, right, or interest to be protected is called the insurable interest. The instrument setting forth the agreement between insurer and the insured is the policy.

The assured should have a legal interest in the thing assured; that is, he should be the owner, factor, agent, consignee, carrier, bailee, mortgagee, or a party having a lien or being liable to loss or pecuniary benefit depending on the thing insured. Thus, the wife has an insurable interest in her husband, or a child in a father.

Delivery of the policy is not necessary to the insurance of an interest, for it may be done by memorandum, or by oral bargain, or by letter.

A policy should describe the person, property, and location thereof with such distinctness as to leave no room for reasonable doubt.

A fire-insurance policy only protects goods so long as they remain in the same building where policy was effected. On change of residence or location, notice of the same should be sent to the agent of the company, unless agreed upon before, and the policy altered to suit. Notice should also be given when material alterations are intended; for an insurer must not alter premises so as to be no longer compatible with description contained in the policy, or increase the insurance company's risk.

In life insurance, a wife may insure her husband, or *vice versa*. A creditor may also insure his debtor, if consent of latter is first obtained. Should the debtor pay his indebtedness to creditor, it does not defeat the right of the latter to hold and collect on the policy.

False representation or fraud vitiates a policy, and insanity excuses a suicide.

That loss which is caused directly by the perils assured against, and which is not excepted to, is recoverable. Thus, loss caused by water in a building adjacent to a fire is recoverable.

An insurance company usually reserves the right to replace what is lost; and, should the insured refuse to accept such proposal, it is presumptive evidence of his having over estimated his loss.

Sworn statements of facts and circumstances of loss are required by insurance companies.

We have said that persons insured must have a legal interest in the thing assured: this proposition may be extended, in cases of insurance against fire, to mean that the interest should be had at the time of loss as well as at the inception of the risk.

In marine or fire insurance the assured can recover only what he loses, no matter how much his policy may call for; *i. e., e. g.*, if A takes out a policy of $5,000 on a stock worth only $2,500, the underwriters will be liable only for the actual loss. In life insurance, of course, the case is different, and the amount stated in the policy is payable.

An insurance contract is governed by the general law of contracts; the parties must be competent, the contract must be mutual, the assent free, and the consideration good. A seal on a policy will not prevent a denial of consideration, and parol evidence is admissible to prove no consideration. In marine policies an acknowledgment of the receipt of the premium money will estop the underwriters from denying it.

A policy cannot be assigned without the consent of the underwriters *before loss*, but it may be afterwards.

A man may insure his life for the benefit of a person who has no insurable interest in him.

It is said that goods not mentioned in a policy are not insured. So it is prudent to name all the articles intended to be covered, and then cover all you may by chance have forgotten by a sweeping clause which will include all.

Fire-insurance policies insure against negligence, although the same may not be stated in the policy; and the same may be said of life policies, unless they contain special clause to the contrary.

Marine policies do not insure against negligence; but if a loss occurs which would not but for the "perils of the sea," the underwriters are liable. Where the "perils of the sea" are not sufficient in themselves to cause the loss, no liability attaches to the underwriters.

In a fire policy the term "fire" does not include lightning, or explosion by gunpowder; and underwriters are not liable for such, nor for damage occasioned by heat or smoke where the flames do not burst forth: but when this last occurs, they are liable for damage by heat or smoke in an adjacent building. They are not liable for loss occasioned by a cause not insured against; but they are liable for damage to goods removed from a building, or for theft in case of fire.

Death from any unexpected event happening, as by chance, is an accidental death; but death by sunstroke is not so considered. It is laid down that, if a man subject to heart disease attempt to wade a river, and while so doing has an attack and is drowned, it will be an accidental death.

Accident policies, which insure against accidents while travelling, include all accidents occurring during the prosecution of the journey, in all the term implies.

Total disability in a policy does not mean that a man should be confined to his bed or to his house, or that he should be totally disabled: it simply means a disability to perform the *whole* of his usual business.

Provisions in a policy that no change shall take place in your occupation do not mean that you are prohibited from entering any other employment temporarily: it is intended to prevent a total and permanent change in your occupation, and thereby increasing the risk of the company.

Lower Canada.—All persons, capable of contracting, may insure objects in which they have an interest, and which are subject to risk. Policies of insurance may be transferred by endorsement or delivery, or by delivery alone, subject to the conditions contained in them. But marine and fire policies can be transferred only to persons having an insurable interest in the object of the policy. In the absence of any consent or privity on the part of the insurer, the simple transfer of the thing insured does not transfer the policy.

EQUITY

IS that branch of civil and remedial justice which supplies that wherein the law is deficient. The avowed principle upon which the jurisdiction was first exercised was the administration of justice according to honesty, equity, and conscience, which last, it is said, was unknown to the common law as a principle of decision; and in the days of Richard II., of England, petitions referred to the Chancery Court for hearing were accompanied with the direction, "Let there be done by authority of Parliament that which right, reason, good faith, and conscience demand in the case"; and it is upon these principles that equity is administered to-day.

The common-law courts are hampered in the administration of justice by a multiplicity of forms and fictions; and in this respect it may be likened to a horse-car, which can only run on tracks of sufficiently wide gauge to accommodate its trucks. And, in furtherance of the simile, equity may be compared to a Herdic coach, that will take its passengers wherever they wish to go, and will avail itself of the shortest and most direct way of reaching its destination. Again, if you want to use a Herdic coach, you cannot do it on a horse-car ticket. And so it is with equity and law: if you have a case which the common-law courts will afford a remedy, you must go there; but if not, you can proceed in equity.

In equity proceedings, the following maxims are strictly observed, viz.: —

"*Equity follows the law*," as far as natural justice will permit.

"*Equity once having jurisdiction, never loses it*," notwithstanding that, after certain measures have been taken, the law would then afford adequate relief.

"*Equality is equity*," as in cases of contribution from those liable, or who have reaped a benefit.

"*He who seeks equity must do equity*"; and unless he is willing to do that, a man has no standing in a court of equity.

"*Equity considers as done that which ought to be done*"; *e. g.*, if A agrees to sell a house to B, in the event of A's death before the completion of the sale, equity will treat the house as money; and it will therefore go to his personal representative, and not to his heir.

"*Where there is equal equity, the law must prevail*"; for in that case the man who seeks equity has no better claim than his opponent.

Courts of equity, like first-class hotels, are always open; that is, they have no sessions and do not adjourn. And they require all who come for relief to come with clean hands, for he who seeks equity must do equity; and so, when a man's case is tainted with fraud by his own act, he will not be received. Equity is essentially æsthetic: it abhors crime, and consequently will never interfere in a criminal case, although in days of yore it would occasionally.

Equity requires diligence on the part of her suitors, and for this reason will not enforce a claim barred by statute. Neither will she aid a man to regain his estates which he conveyed for the purpose of fraud; but if I agree to sell a man a house, and afterwards refuse to carry out my agreement, and he applies to equity, I will be compelled to carry out the exact contract, — viz., convey the house. Of course I was liable at law for breach of contract, and would have to pay money damages; but if the other party wanted the house, he could get it only through equity. This is called the specific performance of contracts. And when equity orders a person to do a certain thing, and he refuses or fails to obey, he is said to be in contempt of court; and unless he explain matters satisfactorily, he will be liable to be put in jail till he does as commanded by the court.

Whatever is void at law is void in equity, and a court of equity will not enforce a contract against a married woman or an infant which it could not enforce in their behalf. Contracts must be mutual, complete, and the subject-matter certain; otherwise they will not be enforced at equity. And in all matters the substance, and not the mere form, will be the thing which will receive consideration, and for this purpose equity will go behind the seal, to which the law is wont to give such importance.

LAW OF TORTS.

THE word "tort" means twisted or wrested aside; in law it means a wrong or an injury; or, as Bouvier lays it down, "the commission or omission of an act by one without right, whereby another receives some injury directly or indirectly in person, property, or reputation." Torts are distinguished from contracts by certain qualities, as, for instance, parties committing torts jointly are severally liable, without the right of contribution from each other, and generally death destroys right of action. But, by statutes in the different States, many torts survive the death of the persons injured. Persons who cannot make a valid contract are liable for their torts, as infants, drunkards, etc.

A man is liable to arrest, imprisonment, or attachment upon a claim arising from a contract. Some torts grow out of contracts, or are coincident with them; as, for instance, in the case of a fraudulent sale, or false recommendation of third persons.

Fraud of necessity implies or accompanies contract, and in such a case the law allows the injured one to proceed against the aggressor as a debtor, contractor, or wrong-doer. Where personal property has been wrongfully taken, the party injured may sue on the contract implied in such cases by the law; as, if I take a barrel of flour and convert it into cash, the law will presume, for the benefit of the injured party *only* who waives the tort, a promise to pay for it whether *I* had that intention or not.

The law of the United States gives the right to a party injured to proceed against the wrong-doer by criminal prosecution when the act is a public wrong, as well as by civil suit for damages; for instance, if a man assault and batter me I can have him arrested and punished for the same criminally, because it is a violation of the law of the land, and can also sue him for the special damage occasioned me by his act. Of course the two actions are entirely distinct; the one being a public act, while the other is private.

There may be, perhaps, some instances where public policy would forbid such actions. The law says whoever knowingly and wilfully takes that which is mine into his possession against my wishes, though it be but for a moment, and though it be returned immediately afterwards, is guilty of tort.

In a crime, the criminal intent must be alleged and proven; but in torts this is not always essential, except in cases of assault, slander, fraud, and malicious prosecution, wherein of course it is the very life of the offence. And the general rule, that malicious intent is not necessary to tort, is one of the features which distinguishes a tort from a crime.

That which contravenes no legal right, or occasions no legal injury, is not actionable because done with bad intent. A violation of a statute or an abuse of a privilege may be a tort. An act, though it be innocent in itself, may become wrongful when done without regard to the rights of others, and without suitable regard for the time, or place, or manner of performing it: as, for instance, an officer may arrest a man on an execution for debt; but if he do it on a Sunday, or in church, or at an unreasonable hour of the night, he would be liable.

Whatever I do on my own premises, in the lawful exercise of my rights as owner, does not render me liable to my neighbor, provided the same does not amount to a nuisance; for the law says every man must so use his property as not to injure and annoy his neighbors.

Torts against the character are called SLANDER and LIBEL. The first is defined to be words, either spoken or written, which are injurious to the character of another; and when they are injurious to the character they are actionable, provided always that the words, when spoken only (not written), in their plain and ordinary sense, convey to the mind of the hearer that the person is guilty of an offence for which he is amenable to the law, or that he is suffering from a contagious or infectious disease that will exclude him from good society. Words spoken of a person can never be slanderous and actionable unless uttered in the presence of one or more persons, for the law requires *publication.*

Words which are not actionable in themselves become so when spoken of a person in his profession, trade, or office, and which have a tendency to injure him; and any words defamatory or injurious in their nature, spoken of another without legal justification, are actionable if productive of special damages naturally arising from the slander. Thus, if I tell you that So-and-so is a quack doctor, and you are thereby deterred from employing him, I am liable: so calling a lawyer a "shyster" is actionable, or a mechanic a "botch," or that a grocer sells adulterated articles, or a butcher bad meat.

LIBEL is that which, printed or written, reflects on the character of another, and is published without lawful justification or excuse, whatever the intention may have been. Thus, it is said that libel is any censorious or ridiculous writing, picture, or sign, made with a malicious or mischievous intent towards governments, magistrates, or persons.

Burning a man in effigy, or fixing a gallows at a man's door, renders one liable; or to charge a lawyer with sharp practice, meaning disreputable practice; or that a person is unworthy of the relief of the charitable; publishing a ludicrous story about a man which would tend to make him the subject of ridicule, even though the man has told it before of himself, makes the publisher liable.

The above cases are of the class of torts called actionable, or those upon which actions can be maintained.

We will pass on to the consideration of *indictable torts*, or those which disturb the public peace or good order of society. This crime, for such it is, may be committed by the publication of blasphemous writings, or such as turn the Christian religion into contempt and ridicule, or those which by their immodesty corrupt the public mind, and thus destroy the love of decency, morality, and good order.

To wantonly abuse a foreign minister or ambassador, and thus cause trouble between our own and any foreign government, is an indictable tort. Libels of the dead which tend to cause a breach of the peace are also indictable.

Where libel is published, the sale of each copy is a separate and distinct offence. The publication must be malicious. The malice may be expressed or implied. That which is malicious on its face will be so deemed; but no allegation, however false or malicious, in answer to interrogatories in affidavits duly made in a court of justice, is indictable. The publisher of a libel is to be punished criminally by indictment, and the aggrieved party may at the same time resort to suit for damages. The defence that the statement published is true, and was further without malice, is a good one if proven, because a man cannot be defamed by the truth, and he has no right to a false character, and his true character has not been damaged. The fact that he believes it to be true is not a good defence when it is proven false. But truth is never a defence to a *criminal* prosecution for libel, for the same is likely to cause breach of the peace.

FALSE IMPRISONMENT.

A MAN is said to be falsely imprisoned when he is restrained from his liberty against his will, without authority of law; and this may not only be in a prison, but in the party's own house or room, or on the highway. For instance, if a man should say, "I want you to come along with me," and acted as though he were determined you should go, this is an imprisonment, though he does not lay his hand on you. That display of physical violence which apparently can only be overcome by submission thereto is an imprisonment.

An officer arresting the wrong man by mistake is liable for false imprisonment, though the party bear the same name as the one intended; but if a man intentionally mislead an officer, he has no remedy. An officer must see that there is no mistake in writ or warrant: for if he arrest James Smith, when his warrant calls for John, though James be the party intended, it will be false imprisonment; or if he arrest a party outside of the district named in the writ, he will be liable.

Neither can an officer unreasonably detain a man without being liable: when an officer arrests a man without the necessary writ or warrant, but afterwards obtains it, he is liable. A clerk of a court is liable when he does what he has no right to do, as when he makes out a warrant or writ in defective form, or when he issues it without the order of the court.

The judge may be liable where he issues a warrant under improper circumstances; so officer, clerk, and judge may be liable on a writ issued by order of the judge, as where the cause is not within the jurisdiction of the court.

Attorneys are liable also for false imprisonment, as where they procure by personal direction the service of an improper or invalid writ, or where they obtain the issuance of a warrant by means of false statements; and in these cases it would seem that their clients are also liable.

False imprisonment differs from malicious prosecution thus far, that an action for the first is maintainable only where the writ or warrant is void, or will be so declared by the court upon application; in the second class of cases, the fact that the writ may be good or bad makes no difference at all.

Enticement and Seduction.

UNDER this head it will be sufficient for our purpose to state the broad principle of the law of torts in this respect, which is that, if a person be under contract to serve me, or in my employ, and you entice (meaning by "entice" doing so with knowledge and intent) him away from me, or prevent his coming, or interrupt our relations, you have violated your legal duty, and are liable to me for damages sustained by your act; and it will not matter if you were ignorant of the fact that I was entitled to such service, if, after you learn the fact, you retain him in your employ. And

In cases of SEDUCTION, the man whose wife, daughter, or servant has been seduced, and by reason thereof is incapacitated for labor, has a right to recover for loss of services; or, in the case of wife, for alienation of her affections as well as loss of services.

Trespass.

AN unlawful entry on another's premises is trespass, as is also the unlawful taking of another's goods. An entry upon lands, or a taking of goods by consent of the party in possession or by authority of law, is not trespass. A sheriff has a right to enter to serve a valid writ; and any one has a right to enter a hotel, shop, or business place, or coach of a common carrier.

A man has a right to enter my premises to collect a bill, unless expressly forbidden; or a trustee for a lessor has a right to enter leased premises to see if lessee has committed waste. If A sells goods to B, and the goods are on A's land, B would have a right to go and get them, except that he would have no right (unless expressly granted) to cut trees down; or if a man put lumber on my land without my permission, and I afterwards remove the lumber and put it on his land, this entry is lawful; or if the wind takes my last shirt from off the line and wafts it to my neighbor's land, I am allowed to go and get it; or if my neighbor borrows my shovel without my knowledge and forgets where he got it, I may enter his premises to get my property. There are cases where a man may enter his neighbor's premises to abate a nuisance. Thus, if a shed overhang my land, and the eaves gather and conduct water to my land to my injury, I will have a right to cut the eaves and abate the nuisance.

I may enter my neighbor's premises, if *necessary*, to avoid a mad dog or an irate man. A man may enter my premises lawfully; but if, while in there, he commit a wrongful act, it will render him a trespasser from the beginning. If a man's animals stray upon my premises, I must either treat them as I would my own, or put them off the premises with as little force as possible; otherwise I am liable.

Negligence.

THE law says that he who acts towards others as a *prudent* and *careful* man should, will never be guilty of negligence; and those who, by their failure so to act, cause their neighbor to suffer loss or injury, will be liable therefor. But in no case can the plaintiff recover where the evidence fails to prove that the defendant's act or omission caused, or was adequate to cause, the injury.

In determining whether a man has been negligent in the performance of a task which he undertakes, the criterion will be what would a *prudent* and *careful* man, knowing his duty, whatever it may be, have done under the same circumstances.

An innkeeper will be liable for loss of guests' property, if ever so diligent, unless there be contributory negligence on the part of the guest; in which case, of course, the innkeeper will not be responsible. When I have an attorney or doctor, I have a right to expect from him a fair degree of skill and information, and reasonable care and diligence. If, for instance, a lawyer bring a wrong action, as one of contract when he should have brought one of tort, then he will be liable. So, too, where he is employed to look up a title to real estate. If the title is obviously defective, and he passes it, he is liable. Ignorance or non-observance of the rules of practice of court create a liability. But a lawyer will not be liable for errors of judgment on new points, or of nice and subtle constructions, unless he be in the highest walks of his profession.

So is it with doctors: the diligence required is in keeping with the case, and they are not supposed to have acquired all the wisdom of accumulated ages; but they must be possessed of fair and reasonable skill, and exercise the same amount of care; and, unless they hold themselves out as such, they are not expected to possess the highest degree of skill.

Servants and employés are bound to protect their master's interests, so far as they are intrusted to them; and any want of reasonable care or diligence on their part renders them liable.

A master is also bound to exercise due care in order to insure the safety of his servant from that which the servant cannot learn from his own observation. For instance, if an employer knows that a staging is unsafe and yet sends his servant on it, the master is liable for all injuries sustained. He is also liable for the negligence of his servants, for injuries sustained by persons other than his employés; that is, he is not liable for a servant injured by negligence of a fellow-servant, save where the master is shown to have been personally negligent, as if I hire reckless or incompetent persons, or habitual drunkards.

Public officials are liable if special damages arise from want of due care. (See Common Carriers.)

If my servant, while driving for me, runs into another through his own carelessness, I am liable if he is on my business with my consent. The master is not liable for servants' torts, unless done by the authority of the master, either express or implied. The driver of a team must look out for pedestrians. My servant runs the risk of being hurt in my employment; but the master is not liable if it is occasioned by something beyond his control, as the fright of a horse. One must exercise due care in walking on a slippery sidewalk, if he would maintain upright position or an action for damages. But it is negligence to allow a ridge of ice to remain on a sidewalk; and if a man slips and falls at night, the same care would not be expected of him as would be in the daytime. A man is not bound to stop and see just where he is going to put his foot, nor is he obliged to wear rubbers. If I invite you to ride with me, you are in no way responsible for my negligence; and if I let you drive, I still will be the responsible party. But if we hire the team jointly, then we are jointly liable; but if we hire a driver with turnout, neither of us is liable. I may drive on either side of the road; but I will have to exercise greater care if on the wrong side, to avoid collision. If there is plenty of room to pass, the one colliding would be the party to blame; and although I drive on the wrong side of the road, that will not prevent my recovering damages from a negligent driver, nor excuse a city if I am damaged by a defective road. A pedestrian is bound to exercise all his senses when crossing a highway; if he do not, then he will lose all right of action for damages by reason of his contributory negligence; he has no prior right of way, and he must not calculate too nicely on his chances of getting across unhurt. If a circus exhibition of wild animals licensed by the city frighten my horse, the city will be liable.

* * *

Deceit.

PROOF REQUIRED IN THIS AND OTHER TORTS.

IN actions for damages for deceit, plaintiff must prove,—

1. A false representation of material facts.
2. That the same was made with knowledge of its falsity.
3. That plaintiff was ignorant of its falsity, and believed it true.
4. That it was made with intent to be acted upon.
5. That it was acted upon to the damage of plaintiff; *e. g.*, if I say a man is pecuniarily responsible, and that you can safely trust him for $3,000, I am liable if the statement is untrue, etc.

Deceit may be maintained, to wit: —

1. For a false representation known by the defendant to be false.
2. For a false representation believed to be true, but the truth of which he was bound to know.
3. For a false representation not believed to be either true or false.
4. For a false representation believed to be true, but upon inadequate grounds.

Representation may have been intended for,—

1. One particular individual only, in which case he alone is entitled to act upon it.
2. It may have been intended for several or for many.
3. For any one of a class.
4. For any one of the public.

False representations of a person may consist,—

1. In disparaging his credit, or his title to his property, or his property itself.
2. In attempting to personate him, or his badge of business.

In slander of title cases, plaintiff must prove,—

1. Malice.
2. Specific damage.

In order to sustain an action for a breach of duty in deceit for use of trade-mark, plaintiff must show, —

1. That the defendant knew of the existence of the plaintiff's mark when he committed the alleged wrong.
2. That he intended to palm off the goods as the goods of the plaintiff, or to represent that the business which he was carrying on was the plaintiff's business, or business of which the plaintiff had a special patronage.
3. And that the public were deceived thereby.

If defendant has the words "Revere House" printed upon coaches which he employs to carry passengers from the Boston and Albany Railroad Depot to the hotel above named, but the plaintiff has the exclusive right, by contract with the proprietor of the hotel, to represent himself as intrusted with the patronage of the hotel by the proprietor: the defendant commits no breach of duty to the plaintiff, unless he so makes use of the sign upon his coaches as to indicate that the proprietor of the hotel has granted *him* such a right of patronage.

Malicious Prosecution.

A QUESTION OF PROBABLE CAUSE is a question of law for the judge. Facts on which probable cause is based are found by the jury, and the court determines whether the facts as found constitute probable cause.

Want of probable cause will not prove malice, nor *vice versa*. The jury decides as to question of malice. The presumed or implied malice, in slander and libel, does not exist in malicious prosecution. The only kind which will be considered is actual malice, which is a question of fact to be determined by the jury.

Conspiracy.

IT is necessary in this class of cases to prove the same elements as in malicious prosecution, with this exception, that malice need not always be proved.

In civil actions, where there is no damage sustained, there is no redress.

Assault and Battery.

IN cases of this kind, malice is not necessary to be proved, but want of it may be shown in mitigation of damages.

Bailments.

A BAILMENT is a delivery of chattels by one person to another for a certain purpose, to be returned or delivered in accordance with that purpose. It is a delivery of goods in trust upon a contract, express or implied, that the trust shall be carried out in good faith on the part of the bailee.

Bailees are persons to whom goods are delivered for a specific purpose. Some bailees are bound to take very great care, and slight negligence on their part is sufficient to bind, as in the case of innkeepers, and the common carriers of passengers, and *borrowers*.

A person who borrows goods for his own use is bound to exercise the greatest care and diligence in preserving them from loss or injury, because it is solely for his benefit that the bailment was made; and for this reason he cannot lend, and must apply it to the purpose for which it was borrowed, and that only. He must return it when the time expires for which it was loaned, and he will not be allowed to keep it as security for a demand otherwise arising against his bailor. Of course the bailee's care must be increased with the value of the goods intrusted to him.

Some bailees are required to take only ordinary care (that is, such care as a prudent man would take of his own property), and ordinary negligence would make him liable, as in the case of a party who holds the goods or money of another for safe keeping, without reward; if he take the same care of it as of his own, he will not be liable.

COMMON CARRIERS

CARRY goods for hire for all who need their services, either by land or water; and they include railroad companies, stage companies, truckmen, teamsters, expressmen, horse-cars, and porters.

Common carriers are held liable for all loss or damage occurring during transportation, from all causes save the act of God, and the public enemy, and loss occasioned by frost, fermentation, natural decay of perishable articles, provided the carrier exercise ordinary care.

Carriers doing a general business are liable for damages if they refuse to carry all who offer, without good cause; but any carrier may restrict his business to whatever limit he pleases, and is not bound to accept goods out of that limit.

A carrier may demand pay in advance; he has also a lien upon the goods for his charges. He may limit his liability by contract, or by notice brought home to the knowledge of the owner of the goods, and assented to by him; but he cannot limit his liability for gross negligence.

The bill of lading is the carrier's acknowledgment of the receipt of goods, and is evidence of contract between the parties, and is supposed to contain all the carrier's claim for non-liability. Railway companies, steamboats, and other carriers who allow express companies to carry parcels or packages on their vehicles, are liable, as common carriers, for all loss or damages, without regard to the express companies.

A baggage check is evidence of the liability of the company issuing it. Baggage does not include merchandise, or money, except an amount reasonable for expenses.

Carriers are responsible from the time they receive goods for immediate delivery, and their responsibility terminates when they have arrived at their place of destination.

Common carriers of passengers are those who carry persons for hire, and are bound to carry all who offer, provided they are unobjectionable in character or health, as far as their means will allow. Common carriers are responsible as insurers of goods committed to their care, but carriers of passengers are not; but they are bound to exercise every possible care in regard to all the appliances of their business, and, as far as human foresight can, secure the safety of the passenger. It does not relieve the carrier of this care even if the passenger fails to pay his fare.

Passenger carriers are responsible for the baggage of their patrons. If the servants of the carrier are allowed to carry parcels, the carriers will be responsible for their safe delivery, although they derive no benefit therefrom.

They have a right to their fare upon demand. The carrier is bound to do everything in his power for the safety of his passenger; and, if any injury occurs in consequence of any omission, he is liable: but if accident occurs through the negligence of the passenger, the carrier is relieved. If a man leap from the car, boat, or coach, through a just sense of impending danger, he may recover.

Carriers are liable for the non-delivery of passengers within a reasonable time from what they advertise, but they are not liable for special damages. Where a man is injured by the culpable negligence of a carrier, he has a right to damages for what he has suffered and for what he is likely to lose by reason of the injury.

Carriers may make reasonable regulations as to the management of their affairs, such as to the sale of tickets on certain conditions, etc.; but a passenger who buys a ticket good for this trip only, if unexpectedly detained, may lawfully claim to go on a subsequent day.

Passengers must show their tickets, pay their fare, or run the risk of getting put out.

The overturning of a stage-coach is *prima facie* evidence of neglect of the carrier.

Hotel and Inn Keepers' Liens and Liabilities.

HOTEL-KEEPERS, by whatever name known or called, have a lien upon the effects of their *guests* which are within their possession, for the accommodation furnished them or their servants and animals. It matters not whether the goods which I bring to a house are the property of another; "mine host's" claim is good and must be paid, or the goods sacrificed. A landlord must receive all who come, unless his house is full, or the parties are, for good and substantial reasons, objectionable. He must also take care of all goods committed to his care; and he is liable for the negligence of his servants and for all losses occurring in his house, save they are occasioned by the act of God, public enemy, or the fraud of the guest. The law makes a distinction between guests and boarders. A landlord is liable to his guests for their loss, as stated above; and to recompense him for this, as it were, he has a lien on their goods for his pay: but he has no lien on his boarders' effects, nor does he assume any liability for them.

A boarder is one who bargains for a price per week and pays at that rate, and is usually seated at a table different from that accorded to guests or "transients." The guest, though he may bargain as to the rate per day, has no fixed time for coming or going, and, when ready to go, settles his bill, and, during his stay, is seated by the waiter at the transient table. If a landlord notify his guests that he will not be responsible for loss unless they leave their goods and valuables in his immediate charge, to be put in a place which is designated, he will not be liable (if his requirements are reasonable) to any guest who fails to comply, unless the goods lost were articles necessary for a guest to have in his own room, and where they were not lost through any fault of the owner. A boarding-house keeper is liable for loss occasioned by the negligence of his servants, as he is for his own; but he has no lien on boarders' goods, save where the statute gives it to him. A Holly Tree Inn is not an inn, nor a hotel, within the meaning of the law, neither is a boarding-house. Good wine needs no bush, neither does a hotel need a sign to make it one in the eye of the law. (See chapter on Torts.)

Lower Canada.—Keepers of inns, of boarding-houses, and of taverns, are responsible for the things brought by travellers, who lodge in their houses. They are responsible if the things be stolen or damaged by their servants, or by strangers coming or going in the house. But they are not responsible if the theft be committed by force of arms, or the damage be caused by irresistible force; nor are they responsible if it be proved that the loss or damage is caused by a stranger, and has arisen from neglect or carelessness on the part of the person claiming it.

Executor's Account.

THE first[1] account of [2], executor of the last will and testament of [3], late of [4], in the county of [5], deceased.

Said executor charges himself with the several amounts received as set forth in schedule A (hereto annexed), amounting to . . . . . . $[6]

And desires to be allowed for expenditures and charges as set forth in schedule B (hereto annexed), amounting to . . . . $[7]

Balance . . . . $[8]

(Signature.) ——— ———, *Executor.*

The undersigned, being all the parties interested, having examined the above account, ask that the same may be allowed without further notice.

(Signatures of widow and all heirs and legatees.)

SCHEDULE A.

	$	c.
Amount of personal estate, according to inventory		
Balance of former account		
Amount received from gain on sale of personal estate over appraised value and from other property, as follows		

SCHEDULE B.

Amount paid out and charges, as follows:—	$	c.
1. For expenses of last sickness and funeral		
2. For administration charges		
3. For debts of the deceased		
4. For amounts paid legatees or heirs		

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[1] Insert "second" or "final," as the case may be.

[2] Insert name of executor.

[3] Insert name of testator.

[4] Insert former residence of testator.

[5] Insert name of county.

[6] Insert full amount on schedule A.

[7] Insert full amount on schedule B.

[8] Subtract amount of B from A.

EXECUTORS AND ADMINISTRATORS.

EXECUTORS AND ADMINISTRATORS are not liable upon the contract of their testators, except to the amount of assets they receive, and which are applicable to the satisfaction of the claim sought to be recovered; and they cannot be held to answer for any such claim out of their own estates, unless they have agreed to do so in *writing*, and *signed the same*. In addition to this, there must be a *new* and sufficient consideration for the agreement.

If an executor agree, in consideration of B's refraining from pressing his claim against the estate, to pay him, it will be a good consideration and a new promise.

No action at law is maintainable against administrators or executors to recover legacies or shares, although they may have expressly promised to pay the same, unless as above stated the promise be in writing and signed by the party sought to be charged, and for new promise and good consideration. But if he have assets, his oral promise will bind him.

If an executor fail to order a funeral for his testator, he will be liable personally on an implied promise to the person who furnishes it, but he cannot be charged in his representative capacity. An executor who makes a promissory note "as an executor," with interest, on demand, is personally liable, unless he adds "out of the assets." So also an executor who submits a matter to arbitration, without limiting his liability, is personally liable for the award. If he indorses a note or bill with his name, he is liable personally, unless he adds "executor or administrator."

A person who meddles with the goods and affairs of the deceased may become what the lawyers term *executor de son tort*, or an executor in his own wrong, and lay himself liable to be sued not only by the rightful executors or administrators, but also by the creditors of the deceased, and this may happen although such meddler does not profess to act in such a capacity; but he cannot prejudice, by act of his own, the rights of the legal administrator or executor. But he who acts out of motives of charity, such as to provide a decent funeral, pay the debts with his own money, gather the goods to prevent fraud, and feed the cattle, is not liable.

The law says that an agent employed to sell cannot become the purchaser. To illustrate: an executor could not legally buy his testator's estate, nor any of his debts, for he is bound to give every advantage to the estate.

Equity will not allow a man acting for another to set his own interest above the good faith which his principal is entitled to; and in the case of executors and administrators, they stand in the same relative position to their estates as the agent does to his principal.

In most States, bonds are required from executors as well as administrators, unless the testator exempts them from giving bonds in his will: he may also exempt his trustees, whom he appoints, or directs to be appointed. Idiots and insane persons cannot become executors or administrators; and if they become so, they may be removed after appointment.

The source of an executor's title is the will. Probate is only official evidence of their title; *before* probate he can collect and pay bills, recover assets, sell stock, and pay legacies, but he cannot maintain a suit at law till *after* probate. He has equal power with administrator, but must apply goods for such purposes as are sanctioned by law.

Co-executors are regarded as one in law, so that the act of one is the act of all, generally speaking, but absolute and unqualified good faith is required.

The duties of an executor are, to bury the testator decently, but not extravagantly; he must gather all the goods of the deceased, peaceably if he can, but if not he must resort to law; make a list of the same, prove the will, give notice of his appointment, and call for debts and credits.

An executor must do as his will says with personal effects, and the surplus must be turned into money and divided as if there were no will. But an administrator must collect, appraise, and sell the whole. Public auction is the best way to do this.

An executor is liable for interest on testator's unemployed money in his hands, provided want of care is proven. He must be ready to account at all times to the proper authorities, and file his account once a year, or as prescribed by statute. He must also pay the debts, as required by statute, such as the debts due for funeral, to the United States, etc.

An executor must give his assent to a legacy before it is complete and perfect in law; but if he refuse so to do, without just cause, equity will compel compliance.

If an executor or administrator finds the property of the deceased is not sufficient to pay all the lawful debts, then he should immediately notify the Probate or Surrogate Court, and take such further action as it may direct.

Guardians.

A GUARDIAN is to all legal purposes a trustee, and in all cases should be required to give bonds for the faithful performance of his duty, though all the States do not require it.

The father, and after him the mother, is the natural guardian; and the court will not consider it to be its duty to appoint another where either is alive, but the father may appoint by will. At the age of fourteen the ward can choose his own guardian, but the choice must be ratified by the court.

A married woman may act as guardian if her husband consents.

A guardian cannot reap any advantage from his ward's estate, but must account for all benefits. He can invest the ward's money in real estate only by order of court, and, *vice versa*; he may sell the personal property, or dispose of it as he sees fit.

All the contracts between the guardian and the ward (especially if to the advantage of the guardian), after the ward becomes of age, are viewed with suspicion.

A ward cannot sue his guardian at law, but may proceed against him by bill in equity, and have him render his account. The guardian is another species of the genus agent, and many of the laws of agency are applicable to him.

The guardian cannot bind the ward by any contract, nor the ward the guardian.

EVIDENCE

A FEW words relative to evidence may not be out of place, inasmuch as there are numerous good and intelligent people who seem to lose their wits when called upon to testify in a case. There is no necessity for this; and in nine cases out of ten it arises either from ignorance or too great a knowledge, and consequent fear, of the law.

Evidence is that which tends to prove or disprove any matter in dispute, or to influence the belief respecting it; and no matter in what shape it may come, or through whatever material organ it is received, it is evidence; and when sufficient to produce a conviction, it is called proof.

No evidence is admissible which is not under the sanctity of an oath or an affirmation, save dying declarations. When we cannot get the facts of a case by actual or personal observation, then there are only two ways by which we can do so. The *first* method is by information derived directly or indirectly from those having an actual knowledge of the facts; the *second*, by way of *inference*,—*i. e.*, from certain established facts we infer others. As Judge Lord puts it, a ray of sunlight on the floor is circumstantial evidence that the sun is shining; we see the ray on the floor, but cannot see the sun, but we infer the sun is shining.

The *first* method is based on abiding faith in human veracity, and the *second* on human experience. The law is very peculiar, and will not be satisfied with anything less than the best in the way of evidence; as, for example, if in a trial of a case the subject-matter is a deed, the deed must be produced, or, if not attainable, then a copy, or, if no copy, then the next best evidence. So never go into court without the BEST evidence which you can get for your case. A written document is *prima facie* evidence that its contents are true. A document under seal is generally, though not always, conclusive evidence of good and sufficient consideration ; but a bill of exchange or a promissory note is not at any time. Averments under seal cannot be controverted by evidence of the party who made them; this is called *estoppel.*

Oral evidence is admissible to *prove* oral contracts, but only to *explain* written ones, and will not *vary* them a particle; for instance, if a legacy is left to John Smith, oral evidence is admissible to show which John Smith it was. But if five hundred Turkish war bonds were left to John Smith, no evidence will be admitted to show that United States bonds were intended.

A *receipt* is always explainable. Evidence is sometimes admissible to prove want of consideration in a deed or document under seal. If I give a note in which no time is specified for payment, it will be a demand note, and no evidence is admissible to show that a longer time was agreed on.

Evidence of customary or technical usages is admissible to explain such terms; as, there is a case reported where the subject-matter was a thousand rabbits, and evidence was admitted to show that by the usages of that trade twelve hundred was a thousand.

Hearsay evidence is, at times, not only admissible, but very desirable when you want to prove matters relative to character, usage, or customs, pedigree, relationship, general reputation, and declarations (when the fact which they accompany is material), and where the act in its quality or nature is material. As a rule, however, *hearsay* evidence of *mere* declaration made *to* the witness by others is not admissible, because, if generally admitted, it would lead to uncertainty and confusion.

This rule, however, has its exceptions, as have all other rules, and they are, first, hearsay evidence is admissible to show what a witness (since dead) testified to in a former trial of the issue between the same parties; also to prove facts of a public nature, and in such cases must be confined to public declarations, or the parties in a position to know whereof they affirm.

The presence of an *incentive* to bias will weaken any evidence. Absence of motive is an indication of innocence; herein the law plainly says that the nature of man is evidence to her. And so in nearly all matters man's conduct is part of the evidence submitted; yes, and also his bearing in court.

The conduct of the accused in a criminal suit is closely scanned; and so it is in many matters of contract, because the conduct of the parties is evidence of their intentions.

A man's own acts and declarations are always admissible against him, either because they afford light, or because they are the fact in dispute.

An honest and sensible witness will state those facts, and those only, which he has actual knowledge of, and to the extent of that knowledge and no more. A witness should state all he knows relative to the matter in question slowly, and on no account undertake to be smart, for the chances in a court are all against his success. Remember that you are under the protection of the court, and that no lawyer has any power over you for good or evil of himself. As you cannot impeach or discredit a witness whom you have called, be careful whom you call.

An expert may give his opinion, and he is the only one expected to do so from the witness stand.

To entitle a dying man's statement to credit, it must be made by him while in expectation of death; *i. e.*, the expectancy of death must predominate over the hope of recovery.

LAWS

Relative to the Mortgage of Personal Property in the Several States and Territories.

A MORTGAGE is an absolute conveyance in its form, but is intended only as a pledge for the security of a debt; and when the debt is paid, the mortgage becomes void, and should always contain a clause to that effect. Fraud, or want of good faith, will invalidate a mortgage. Personal property is sometimes called chattels, and hence we have the term "chattel mortgages," which simply means mortgage of personal property.

A bill of sale will answer for a mortgage of personal property if a proviso is inserted that it shall be void upon payment of the sum which the mortgage is given to secure. All mortgages should contain a clause giving right of redemption. Parties interested directly should proceed in this, as in all legal matters, with great care, as a false move is sometimes very troublesome. The true and only safe way is to find the full requirements of the law and follow it to the letter.

Alabama. — A mortgage, to be legal in this State, must be recorded. But if property is brought into this State subject to such incumbrance, it must be registered within four months; and if such property be removed to a different county from that in which the grantor resides, the conveyance must be recorded within six months from the removal. A mortgage must be recorded in the county where the property is, and where the grantor resides. Mortgagees must enter payments on the margin of the record which they receive, at the request of any *bona fide* creditor of mortgagor or the mortgagee himself.

Arkansas. — As a lien, a mortgage is of no avail except recorded in the county where the mortgagor resides. When paid, mortgagee must so indorse on record within sixty days. But a mortgage may be filed if indorsed by mortgagee, and be valid against all comers for one year. Mortgage on future crops is valid.

California. — Mortgages are void as to third parties unless recorded, and accompanied by affidavit that all parties thereto are acting in good faith and without fraudulent intent; must be recorded in county where mortgagor lives and where the property is, or in county to which it may be removed. Upon satisfaction of mortgage, mortgagee must give discharge; penalty, $100 for refusal so to do.

Colorado. — As against third parties, a mortgage is not valid unless there be a delivery to the mortgagee of such property, in whose hands it shall remain until the lien expires, or unless the mortgagor shall acknowledge such mortgage before some officer authorized to take acknowledgments of deeds of real estate in this State. If the mortgagor retain possession of the property mortgaged, the mortgage must expressly provide for such possession. The conveyance of such property without notice to mortgagee is deemed larceny; concealment of such property is misdemeanor. Failure to record mortgage will not invalidate lien if party obtaining interest in such property has notice of mortgage.

Connecticut. — On property not perishable in its nature a mortgage is good, although the grantor retains possession, but the deed shall be recorded as mortgages of lands. Property exempt from execution is a proper subject for mortgage. The conveyance of any other kind of personal property is void as against creditors unless accompanied by possession. Fraudulent sale or removal of mortgaged property is punishable as a misdemeanor.

Dakota. — Mortgage must be signed by two witnesses, and no further acknowledgment is required. It is void unless filed in the county where the property is, and only runs three years. It may be renewed by affidavit as to amount of claim, if not satisfied. Creditor of mortgagor may attach or levy if he pays mortgagee his whole claim.

Delaware. — A mortgage, if recorded in the county recorder's office where said property is, within ten days from execution, will be valid for three years. Affidavit of good faith of parties, and absence of fraudulent intent, must be filed with mortgage. To remove such property without consent is a misdemeanor. The lien of a purchase-money mortgage, recorded within sixty days after it is made, has preference to any judgment or lien against the mortgagor.

District of Columbia. — A mortgage not recorded within twenty days after execution is invalid except as between parties thereto. No bill of sale, deed of trust, or mortgage for property exempt by law from execution, is binding unless joined in by wife.

Florida. — Mortgages of personal property are effectual and valid only when recorded in the office of record for the county in which the mortgaged property shall be at the time of the execution of the mortgage, unless the said property is delivered to the mortgagee within twenty days from execution, and he retains possession of the same. Real and personal mortgages are admitted to record on same proof.

Georgia. — Mortgage is only security for debt, and passes no title. It must be recorded within thirty days in the county where mortgagor resides; if a non-resident, then where the property is. Donee is liable for taxes, and so is the property, no matter where found. Property mortgaged out of, and brought into, the State must be recorded within six months.

Idaho. — Mortgage must state residence of parties thereto, rate of interest, the sum to be secured by the mortgage, when and where payable. Grantor shall make oath that he is acting in good faith, and that the mortgage is *bona fide.* It must be recorded in county where property is, also where grantor lives. No mortgage made otherwise than as above shall be valid unless possession accompanies title. It may be attached by grantor's creditors if they pay mortgagee amount due him with costs.

Illinois. — No conveyance of personal property having the effect of a mortgage of personal property shall be valid against third persons unless possession is given to mortgagee, or a stipulation to the effect that the property is to remain in possession of grantor. Must be acknowledged and recorded in county where grantor lives, and, if non-resident there, where property is. Mortgage is valid for two years only.

Indiana. — No mortgage of goods shall be valid against any other person than the parties thereto, where such goods are not delivered to mortgagee and retained by him, unless said mortgage is acknowledged, as in case of deeds, and recorded in recorder's office of county where mortgagor resides within ten days thereof. The concealment or conveyance of such property without consent of mortgagor is misdemeanor.

Iowa. — A mortgage must be recorded in the county where holder of property resides, and must be acknowledged as other conveyances. The sheriff can foreclose without action in court, and the sale shall be in same manner as other sheriff sales. Unless otherwise provided, the mortgaged property is left in possession of mortgagor.

Kansas. — A mortgage must be recorded where the property is. When immediate delivery does not take place, the mortgage is void as to grantor's creditors. It is void in one year unless affidavit of non-satisfaction is filed.

Kentucky. — The property mortgaged may remain in the possession of the mortgagor if recorded, but not otherwise. Five years' possession gives title against mortgagee.

Louisiana. — In this State there is no mortgage of personal property. The law allows the following liens upon portable property : The privilege of vendor on goods not paid for ; for loans advanced for supplies and necessary expenses, also for debts due for same ; the privilege of owner in property leased; liens for labor and materials furnished on buildings repaired or erected. To avail of the privileges a statement under oath of indebtedness in detail, recorded in parish where property is, is necessary, and, to have effect against third parties, the record must be made the day the contract was entered into. Mortgages made in good faith in other States will be recognized here.

Maine. — Mortgages made to secure over $30 are void unless possession is given to, and retained by, the mortgagee, or the mortgage recorded in the town where the mortgagor lives, if a resident of the State; if not, then where the property is.

Maryland. — If mortgages are properly acknowledged and recorded as bills of sale, even though remaining in possession of mortgagor, they are valid, provided the mortgagee shall make oath at the time of execution, before some person duly authorized, that the consideration stated in the bill of sale is true and *bona fide.* They must be recorded where the vendor resides within twenty days from date, and they may be acknowledged before any person duly authorized. If acknowledged within the State, it must be in the city or county where vendor resides, and before a justice of the peace.

Massachusetts. — A mortgage must be recorded where the mortgagor resides when the mortgage is made, and in the city or town where he has his usual place of business. Mortgage must be recorded where the property is when the mortgage is made, if mortgagor resides outside the State, unless mortgage be recorded within fifteen days from date thereof, or the property be in possession of mortgagee. It shall not be valid against any person other than the parties thereto, except in the case of a contract of bottomry, or transfer, or mortgage, assignment of a ship or vessel, and also except in case of any transfer or mortgage of goods at sea or abroad, if the mortgagee takes possession of such goods as soon as may be after their arrival in this State. When a sale of personal property is made on instalments, and the condition is broken, the seller may retake property, but the lessee shall have the right to redeem in fifteen days by payment of balance due and costs.

Michigan. — If mortgagor be a non-resident, the mortgage, if unaccompanied by delivery of property, must be recorded where property is; if resident, in the office of the clerk of the city or town where the mortgagor resides. The mortgagee must, before the expiration of each year, file an affidavit stating his claim on the property. Mortgagee may purchase at sale under foreclosure. Provisions of mortgages as to foreclosure should be full and explicit, and they will have the weight of law.

Minnesota. — Every mortgage not accompanied by immediate delivery is void as to creditors of, and purchasers from, grantor, unless it appears that it was executed in good faith, and a true copy is filed in the place where the property is, and a copy where the grantor lives, if in the State. It is valid only for two years.

Mississippi. — Mortgages are notices from date of record to third parties, and must be recorded in the office of the clerk of the court of chancery for the county where the property is. They must be acknowledged or proved before recorded. If the property or any part thereof be removed to another county, it must be recorded or proved. Mortgage is void if it omits provisions relative to foreclosure, sale, etc., and may be foreclosed in accordance with such provisions.

Missouri. — All mortgages, gift-deeds, etc., are void as against creditors and subsequent buyers, unless duly acknowledged, proved or recorded, or possession of the same is given the grantee and retained by him.

Montana. — Mortgages are good for one year only, when accompanied by immediate delivery of chattels, and continued possession by grantor, or by the acknowledging and filing of the mortgage in the county where grantor lives, accompanied by affidavit in good faith and without fraud, or, if non-resident, then where the goods are at the time. The chattels may be taken on execution if the debt, interest, and costs are paid to grantee.

Nebraska — Mortgages are void if not filed in county where grantor lives, or, if non resident, where property is. Mortgages must contain averment of good faith and absence of fraud; otherwise absolute and continued change must take place. The mortgage ceases to be valid in five years.

Nevada. — Mortgages are not valid unless accompanied by possession or recorded, and contain affidavit of good faith.

New Hampshire. — Every description of personal property may be the subject of a mortgage. The property must be delivered to and retained by the mortgagee, unless recorded, with oath attached, in the town where the mortgagee resides, or, if non-resident, where property is. Perjury is the penalty of falsity.

New Jersey. — Mortgages are void as to creditors wherein actual and continued change does not take place in possession of chattels, and unless acknowledged or proved, and shall have the validity of mortgages of real estate. Mortgages of not over $200 may be foreclosed in an inferior court of common pleas.

New Mexico. — A mortgage is void when immediate delivery and actual and continued change in possession do not take place, unless recorded in the county where property is. Mortgage expires in one year, unless received within thirty days from the end of the year, accompanied by affidavit in good faith.

New York. — A mortgage to be valid as against purchasers and creditors, there must be an immediate delivery and actual continued change of possession, or mortgage must be filed in city or town where mortgagor is resident, or, if non-resident, where property is. Mortgages are not valid for more than one year, unless re-filed within thirty days next preceding the expiration of time of each and every term of one year.

North Carolina. — Mortgages are not valid unless there be immediate delivery and actual and continued change of possession in the property, or unless it be recorded in the county where grantor resides. In case of non-residence, it must be recorded where the property is.

Ohio. — A mortgage is valid if immediate delivery and actual and continued possession take place, or if a copy be deposited with the clerk of township where mortgagor resides, or, if non-resident, where property is. Mortgagee must make affidavit as to the amount of his claim. At the end of one year the mortgage will be invalid, unless within thirty days prior thereto it be renewed by new affidavit, and is again filed with copy of mortgage.

Oregon. — A mortgage must be filed in county clerk's office, and runs only one year. It may be renewed yearly by mortgagee making affidavit as to the amount of his claim thirty days prior to expiration of year, and filing same in clerk's office with copy of mortgage.

Pennsylvania. — No provision for mortgages of personal property.

South Carolina. — A mortgage is valid if recorded within sixty days in the office of the registrar of mesne conveyances in the county where property is situated. The clerk of the court of common pleas is *ex-officio* registrar in all counties except Charleston.

Tennessee. — A mortgage must be registered and proved in the county where mortgagor resides, or, if non-resident, where property is. A mortgage is foreclosed by bill in equity and decree therein, or may be foreclosed in accordance with power of sale which mortgage may contain.

Texas. — A mortgage, unless recorded in the county where the property is, is void as against creditors and *bona fide* purchasers without notice. A mortgage is valid between the parties thereto.

Vermont. — Immediate delivery of and actual and continued change in possession, with due formality, with affidavit of good faith and absence of fraud, are conditions requisite to constitute a valid mortgage. Machinery mortgages are recorded same as real estate.

Virginia. — Deeds of personal trusts take the place of chattel mortgages, and any personal property may be conveyed thereby, and thus become security for debts. They must be recorded to have any force in favor of creditors.

West Virginia. — A mortgage is void unless there be delivery to, and continued possession by, mortgagee. The common law governs mortgages of personal property.

Wisconsin. — A mortgage is not valid except filed with the clerk of the town where the mortgagor resides, if in the State if not, then where the property is. It is invalid as to third parties, unless the property be delivered to the mortgagee and remain in his possession. It is void unless renewed by affidavit within two years.

State Insolvent Laws.

THE National Bankrupt Law lately repealed, and which superseded all State enactments on the question of insolvency, is likely very soon to be re-enacted. The business interests of the country require some law, uniform and general in its provisions, to regulate and equitably adjust transactions arising from our interstate commerce.

The late national law on this subject was founded on the Massachusetts State law, and its repeal refers bankruptcy proceedings to the State laws.

The following is a digest of the laws of each State bearing prominently on the questions of insolvency and assignments:-

Maine. — Assignments are allowed and will be held to cover all property. Creditors have three months' time to avail themselves of the assignment. Has a system of insolvency both voluntary and involuntary. If debts are less than $300, the debtor may be discharged from arrest by making a general disclosure. When not less than $300, assignees may be elected and approved of by court, with power to dispose of property, divide assets, and pay expenses. A discharge may be annulled within two years, where it can be proved that debts have been contracted by fraud and breach of trust.

New Hampshire. — Has no insolvent law. In making assignments no preferences are allowed, and assent of creditors is assumed after thirty days. All claims must be proved under oath within six months, and a schedule of assets and liabilities must be filed by assignee within ten days. Dissenting creditors retain their claims, but take no benefit under the assignment.

Vermont. — There can be no preferred creditors in making assignments. The insolvent law does not affect non-resident creditors. In insolvency matters the probate courts have jurisdiction.

Massachusetts. — The insolvent law of this State has jurisdiction over debts contracted outside the State, if proven. Assignee is chosen by majority in value, and the assent of majority in number and value is necessary for discharge if assets do not amount to fifty per cent or over, but not otherwise, said assent to be filed within six months from date of assignment. The law may be availed of by any person owing $100 or more, and a creditor may apply for distribution of estate within ninety days after the commission of the act of insolvency. In proving claims, original notes must be annexed. Attachments must be made four months prior to initiation of insolvency proceedings, to hold against assignment in insolvency; otherwise they are dissolved. Proof of claim must be made according to statute. Simple affidavit of indebtedness not allowed.

Rhode Island. — Assignments are allowed for the equal benefit of all creditors, but there is no general insolvent law. Preferential assignments are void.

Connecticut. — In voluntary assignments debtor can choose trustee himself, subject to approval of probate court. The court may also appoint trustee on motion of a judgment creditor for over $100 if there be nothing to attach. The debtor receives a full discharge if the estate pays seventy per cent of all claims, and an allowance is made to the debtor for the support of his family.

New York. — Assignments are admissible, and preferences are allowed. A debtor imprisoned on an execution for over $500 may, after three months' imprisonment and the assignment of his property, obtain his discharge; and, on an execution for a less sum, he may be discharged on making an assignment of his property.

New Jersey. — All preferred assignments are invalid except wages of servants, laborers, etc., up to $300. A debtor may be discharged from arrest by delivering up all his property to his creditors.

Maryland. — Petitions may be either voluntary or involuntary. An involuntary petition may be filed by one or more creditors whose debts aggregate $250, giving causes required by statute. A debtor, on being discharged, is released from the claims of all creditors living in the State, and also from the claims of such non-resident creditors as are filed in the proceedings. No assignments with preferences are allowed, but assignments for the benefit of all creditors are valid.

Delaware. — No preferred assignments allowed, and there is no provision for the discharge of the debtor upon his making an assignment. The schedule of property assigned must be filed within thirty days, when the chancellor appoints two appraisers.

Virginia. — No insolvent law. A debtor may voluntarily assign his property for the benefit of his creditors, and may make preferences. The unsatisfied claims of such creditors are not thereby invalidated.

West Virginia. — No insolvent law. Assignments may be made, but do not act as a release. A debtor under arrest may be discharged by conveying such of his property as is not exempt by law. Assignments must be filed in the office of clerk of county court, and must be acknowledged as other deeds. In assigning real estate, the assignor's wife must so acknowledge it as to bar her dower.

North Carolina. — Preferences in assignments are allowed. Debtor may be discharged by assignment for benefit of all his creditors, but any property which he may acquire subsequently is liable for his debts. On proof of fraud or concealment, debtor may be imprisoned till his effects be fully investigated.

South Carolina. — A debtor when under arrest can effect his discharge by making an assignment of all his property. The compensation of assignees is five per cent, and they must report to creditors every three months. The claims of creditors who have not participated in dividends are valid.

Pennsylvania. — No insolvent law. An assignment does not secure the discharge of a debtor. Preferences are allowed where specific property is assigned as security. The assignee must act under the direction of the Court of Common Pleas, and must file his inventory within thirty days.

Ohio. — No preferred claims allowed, except for wages to the amount of $100, and personal taxes. An inventory must be filed by assignee, in probate court, within thirty days, and a copy of the assignment within ten days. The claims of creditors must be presented within six months, and suit must be brought within thirty days if they are rejected. Assignments do not operate against the claims of creditors.

Dividends are payable in eight months from assignee's appointment.

Kentucky. — Preferred claims not allowed. An assignment may be made for the benefit of all the creditors, but debtor cannot be discharged till debts are paid in full. Trustee is required to give bonds, and his account must be settled in two years.

Tennessee. — No insolvent law. Preferences are allowed. A bond is required from assignee, when the value of property exceeds $500. An assignment does not release debtor from liability.

Indiana. — Assignments for the benefit of all the creditors valid. No preferences allowed. The assignment must be signed and acknowledged, and filed within ten days after its execution with the recorder of the county in which debtor resides. A bond must be filed in circuit court, also copy of assignment, by trustee, in same court, within fifteen days after execution of assignment. The property must be appraised by two reputable householders, and an inventory must be filed in court by trustee within thirty days. Property to the value of $600 must be set off to debtor's credit, and balance sold publicly or privately, as the court may approve. *Pro rata* dividends are declared, and debtor is not released from his liability.

Illinois. — No preferred claims allowed. Debtor, after assignment, is not released from his liabilities. Jurisdiction in cases of assignment is vested in the county court. Claims must be proved within three months; otherwise they draw no dividends till all properly presented claims are paid in full. The final account of assignee must be rendered within one year, and he must file bond, inventory, and valuation. The debtor, with a majority of the creditors in number and amount, may discontinue proceedings at any time. All debts must be paid *pro rata.*

Michigan. — Preferences are allowed if not done with intent to defraud. The relief afforded insolvent debtors by the law of 1871 is not much availed of. Assignments may be made beneficial to all creditors.

Wisconsin. — Assignments for the benefit of all creditors only are allowed, and a discharge exempts debtor from all further liability. Petition must be filed in Supreme or Circuit Court. Creditors can contest right of assignment, and demand jury trial.

Minnesota. — Preferred claims not allowed, except debts for wages to servants, mechanics, and clerks, for services performed by them within three months next preceding the date of assignment. The bond given by assignee, with two or more sureties, must, together with inventory, be filed within ten days after assignment.

Dakota. — Has no insolvent law. Assignments are valid when made without preferences, but invalid if any creditor refuses his assent thereto, or if any benefit is reserved to assignor, or if any power is conferred on assignee which has a tendency to delay the conversion of the property.

Iowa. — Assignments may be made for the benefit of all creditors. Creditors must prove and file their claims with the assignee within three months from date of assignment. The debtor is not released from his liabilities after assignment.

Missouri. — No preferred claims allowed. Assignee must give bond within three days after assignment, and must file inventory of assets within fifteen days. Consent of creditors is necessary to release debtor from his liabilities. Three months' publication must be given by assignee of the day set apart for hearing claims.

Kansas. — Assignments do not release the debtor, and preferred claims not allowed. Clerk of district court notifies all creditors (above ten dollars), and an assignee is appointed by them if a majority be present, otherwise by the court. Assignee is subject to the order of the court. Assignments must be executed and recorded like conveyances of real property.

Nebraska. — All preferences in assignments are void except payments for wages of labor, when they must not exceed severally $100. Assignee must give bond, and must file inventory of assets in district clerk's office within thirty days.

Colorado. — No insolvency law.

Utah. — No insolvency law.

Arkansas. — Assignments with or without preference are valid. The assignee must sell at auction within one hundred and twenty days all the property assigned, and must give a bond in double the amount.

Texas. — No preferred claims valid. A general assignment must be recorded, with sworn inventory annexed, of all creditors, giving details of claims, etc. Assignments may be made with such creditors only as will accept their *pro rata* in release of debtor. It is a felony to conceal property before or after assignment with intent to defraud.

Louisiana. — Assignments may be made for the benefit of all the creditors, but mortgage creditors may ask for the sale of sufficient to satisfy their claim. A syndic is elected by the creditors, who gives a bond for the proper management of the estate. The final release of debtor can only be obtained by consent of the majority of the creditors in number and amount.

Mississippi. — Has no insolvent law. Assignments with or without preferences are valid if made in good faith. Debtor is not released from liability by assignment.

Alabama. — Has no insolvent law. Assignments without preferences are legal, but do not release debtor from liability.

Georgia. — Has no insolvent law. Assignments with or without preferences are valid when made in good faith, and no benefit is reserved to the assignor. No imprisonment for debt.

Florida. — No insolvent law. Property may be assigned with or without preference.

Arizona. — No insolvent law.

Wyoming. — No insolvent law. Assignments may be made legally without preference.

New Mexico. — No assignment or insolvency laws.

Montana. — No assignment or insolvency laws

Idaho. — If a debtor makes an assignment in good faith, it releases him from all liability.

Washington Ter. — The debtor may be discharged under insolvent law, if his assets equal one third of his debts, and no preference shown or fraud proved.

Oregon. — No insolvent law. Assignments, to be valid, must be made for the benefit of all creditors, in proportion to the amount of their claims. Assignee can dispose of all property, and divide proceeds among creditors *pro rata.* An assignment does not release the debtor from liability.

Nevada. — Assignments are forbidden. Insolvent law discharges debtor from debts mentioned in his schedule, without consent of creditors, or percentage realized from assets.

California. — Assignments are valid without preferences, and under them debtor is discharged from his liabilities. A discharge is not allowed when the debts due are by a person acting in the capacity of a commission merchant, banker, or broker.

New Brunswick. — Insolvent Debtor's Act. Any person confined in jail or on the limits in any civil suit unable to obtain his support may, on application to the Judge of the Supreme or County Courts, receive an order for payment by the suitor of five shillings per week, and if the debtor is in receipt of this allowance for six months he shall then be discharged by the Judge or Justice who made the order. Any confined debtor who offers to pay or assign his property to the suitor, and the latter refuses to accept, may, by giving due notice, sell by public auction, and upon tender of the proceeds, and refusal by suitor to accept, may pay the same to any creditor, and shall then be entitled to his discharge. The possession of personal property by the debtor to the value of fifteen pounds shall not prevent him from taking the benefit of this act.

Nova Scotia. — Insolvent Debtor's Act. A prisoner confined in jail for debt may petition the officers of the court confining him praying for a discharge under the terms of the act. He must exhibit a schedule of his liabilities and assets, and make a formal assignment to the execution creditor of all his property, except wearing apparel, and the instruments of his trade to the value of $40, and may be remanded to jail for any period less than a year on proof of fraud in the contracting of the debt or subsequent disposition of his property.

Copyrights and Patents.

ANY author, inventor, designer, or proprietor of any manuscript, book, composition, engraving, writing, or design, etc., who is a citizen or resident of the United States, may, upon complying with certain requirements, obtain the sole and exclusive right to print, publish, copy, or dramatize; and this right is good for twenty-eight years, with a right of renewal for fourteen more. And persons who desire to exercise this right wholly or in part (in a legal manner) must obtain the consent of the owner in writing, signed by two witnesses; otherwise he shall be liable in damages. And, according to this law, if you steal, regardless of your intentions, you are liable, and the quantity of matter stolen will not make any difference; but the question will be, Does the new book tend to supplant the one from which the matter was taken? and if it does, then it is an infringement. If it is a *bona fide* original composition obtained from ordinary sources, and not a servile or evasive imitation, it will not be held as an infringement. The resemblance must be striking, and so uniform as to lead one to conclude that one is a substantial copy of the other, or was mainly borrowed from it. The mere fact that parts or pages (in methods or illustrations) resemble the copyrighted work is not enough.

Translations without license are allowable where the author has not expressly reserved them.

It is permissible to copy and publish the works of any foreign author who is not a resident of this country.

The law will not require the book to be new if the treatment is original in some degree; and the law will protect the genuine mental labor of every one, whether it be in the way of compilation, new abridgment, or a new work. The courts will liberally construe the law to protect authors, and it will always regard with favor any abridgment which evinces care, learning, and judgment, for such a work is new and meritorious.

The plagiarist or thieving imitator is one who produces another's work in its own form substantially, and the law will never shield him from the consequences of his act. But grammarians, lexicographers, and scientists are often compelled to give precisely the same definitions as their predecessors, and they cannot be said to be amenable for piracy. For instance, how many definitions can be given for a noun, a point, a straight line, or a circle? The courts recognize this fact, and the only way they have of determining whether the work in question is a servile copy, is to see whether the inaccuracies of the original have also been copied; and if the errors are the same in both works, it is evidence of theft.

A person desiring a copyright must, before publication, send to the Librarian of Congress a printed copy of the title of the book or other article; or a description, if a picture, etc.; or a model or design for a work of fine art; and, in ten days after publication of said work, he must send two copies of the copyrighted book or work; or, in case it is a picture, statue, or work of fine art, a photograph of the same to the Librarian of Congress, who will then issue a certificate. And no copyright is valid unless each copy of the work bears the words, "Entered, according to an Act of Congress, in the year , by , in the office of the Librarian of Congress."

Copyrights are personal property, and may be assigned, and such assignment should be in writing; and the length of time for which it is assigned (if not forever) should be clearly stated, and the assignment recorded with the Librarian of Congress.

Canada Copyright Law is intended for persons domiciled in Canada or in any country having an international copyright treaty with Great Britian. The protection covers anything published or produced in Canada without regard to its having been first produced elsewhere, and ceases when the right expires elsewhere. The right in Canada usually lasts for twenty-eight years, but may be extended fourteen more. Copyrights are obtained in Canada in substantially the same manner as in the United States, and may be assigned in writing before or after they are obtained.

Patents.

IF you think you have a new invention and desire to get it patented, if possible, consult some reputable patent solicitor, and follow his advice; otherwise keep your ideas to yourself, and thus run no risk of being called a fool or having your invention stolen.

Any person, whether citizen or not, who is the inventor or discoverer of anything new and useful, may obtain letters patent on the same.

Joint patents are issued where there are joint inventors. If two men, however, invent a new improvement each on the same machine, they are entitled to separate patents.

Whenever an inventor desires to assign his patent, either in whole or part, he must make application for the same, and make oath to the truth of his specifications, and the assignment must be recorded.

The rights of the inventor, in case of death, descend to his executors and administrators. All fees for examinations must be paid in advance, and the Patent Office will not in any case return drawings, models, or samples; so be careful and preserve duplicates of what you send.

Parties interested, and dissatisfied with the primary examiner's report, or with that of the examiner of interferences, have a right to appeal to the board of examiners on the payment of ten dollars; and, if still dissatisfied, you can, by paying twenty dollars, bring your case to the notice of the Commissioner of Patents. And if he won't do any better by you, and you have any money left, you can appeal to the Supreme Court of the District of Columbia; but same must be taken within thirty days from Commissioner's decision.

Where two or more persons claim to have been the original discoverers or inventors of a certain article, the Patent Office will institute certain proceedings, which are called interferences; and it seems that it does n't make the slightest difference how many patents are issued by the Patent Office for the self-same idea to different parties, for the government can do no wrong. For instance, the genial Commissioner may find that he has given a patent where the party receiving the same was not the original inventor; and, in order to fix the great original all right, he gives him a patent also, saying in effect, "Now you have just the same rights as the other fellow." This is said to be done because a Commissioner cannot revoke letters of patent. In such cases there may be an interference, and generally is. In case of interference, the party complaining must file statement of all details and minutiæ concerning the conception and consequent steps up to the completion of the article patented. These statements are not open to the inspection of the other side till they have filed a replication or statement of their case.

In case of default, or where the evidence is not sufficient to establish anything different from the present position of the parties, or where it is evident that the invention had been in public use for more than two years prior to application of the complainant, the other party shall be entitled to judgment, or *vice versa.*

A reissue is granted to the inventor, his heirs or assigns, when, by reason of an important inaccuracy in the original claim, the patent is inoperative or void; provided, however, it was an accident and not done with fraudulent intent. All applications for reissue must be accompanied by the original patent, or, if lost or destroyed, by a certified copy of the same, with sworn statement of loss.

No particular form of words is necessary to a valid assignment of a patent, either in whole or in part; but they must be in writing, and signed, and require no seal, witness, or acknowledgment.

If a man avail himself of another's invention, in substance and effect, without permission of the inventor, it is an *infringement*, and the fact that he has letters patent for the same will not shield him. Colorable differences and slight improvements are of no import if the same principle is involved, and I have no right to *make* or *use* or *sell* anything of the kind.

A *caveat* is a warning to the Patent Office that you have an idea; and in consideration of this and a fee of ten dollars, and fifteen which you may have to pay your attorney, the Patent Office will notify you when anybody else applies for a patent on your idea within one year, and then you can file your application and both will receive due consideration.

It costs about sixty dollars for a simple patent; *i. e.*, thirty-five for the government and twenty-five for solicitor. But you have six months from the issue of the patent to pay the last twenty dollars to the government; and in case you forget to pay it, your patent is worthless.

Sometimes a patent claim can be put through the Office in six weeks, and perhaps even in less time; but when the officials are not over and above lively in the Patent Office it may, and generally does, take a good deal longer.

To use the word "patent" illegally costs one hundred dollars.

CANADA. — Patents are issued in Canada for a term not exceeding fifteen years, and can be taken in three parts of five years each. The government fee is sixty dollars for the full term, or twenty dollars for each five years.

A model is required, but need not be furnished till the application is allowed. Application for a Canada patent must be made within one year from the date of a patent granted in the United States or elsewhere for the same invention.

Any person, whether a subject of the Dominion or an alien, can obtain a patent. The patent covers Quebec, Ontario, New Brunswick, and Nova Scotia. The thing patented is required by law to be manufactured in the Dominion within two years after the date of the patent, but the Commissioner of Patents may extend the time during which manufacture may be commenced.

Articles patented in Canada must not be imported into Canada to the detriment of Canadian industries.

Election Laws of the United States.

(*See article on Naturalization.*)

MILITARY FORCE AT ELECTIONS.

ACCORDING to the laws of the United States, no military or naval officer is empowered to bring armed troops to places of election; nor is any display of armed force allowed to be made that can be construed into either an indirect or direct intimidation of voters. The spirit as well as letter of the law is that voters should go to the polls free and untrammelled, and that no influence or display by either army or navy, calculated to prevent citizens from registering their political preferences, is or can be tolerated. Troops may be brought to keep peace at the polls if reasonable apprehension be felt of tumult and disorder, or to repel armed enemies of the United States, and then only at the call of the governor of the State or President of the United States.

SUPERVISORS OF ELECTIONS.

For the purpose of avoiding the wrongful refusal of a lawful vote at an election, and to the end that a citizen may not be unlawfully hindered from voting, it is ordered that any two citizens in any city or town of more than twenty thousand inhabitants, or any ten citizens of any Congressional district, may, on application to the judge of the United States Circuit Court in their circuit, and previous to any election, make known their desire to have such election guarded and scrutinized. The judge is required to open the Circuit Court at any place deemed by him convenient, within ten days at least previous to such election or registration. At such court are commissioned two citizens of different political parties, residents of the precinct or election district, able to read and write the English language, and who are designated as supervisors of elections.

DUTIES OF SUPERVISORS OF ELECTIONS.

They are required to attend at all places and times fixed for the registration of legal voters, and to challenge certain persons offering to register; to make lists of those persons who claim they have a right to register and vote, and verify the same; to inspect personally such register, and to sign their names to each page of the original list and every copy thereof; and to act generally in such manner as would detect and expose any illegal additions or removals from such list.

THE DUTY TO CHALLENGE VOTES.

The supervisors are authorized to challenge any vote offered by a person whose legal qualifications either of them may doubt. They are to remain at the ballot-boxes till every vote is deposited and counted, and till the returns as required by law are made, and to exercise a general supervision as to the manner of voting, and as to how the check-lists are kept. Supervisors are further required, on days of election or registration, to take such a position as would best enable them to see each person who offers himself to vote or register; and, on the whole, to so comport themselves that no tampering with either ballot-box or check-list may take place.

TIME OF RESIDENCE REQUIRED IN STATE, COUNTY, AND PRECINCT BEFORE VOTING.

	STATE.	COUNTY.	TOWN.	WARD OR PRECINCT.
Alabama	1 year	3 months	....	30 days
Arizona	1 year	10 days	....	......
Arkansas	1 year	6 months	....	30 days
California	1 year	90 days	....	30 days
Colorado	6 months	......	.. ....	......
Connecticut	1 year	......	6 months	......
Dakota	90 days	......	....	......
Delaware	1 year	1 month	....	......
District of Columbia	......	......	....	......
Florida	1 year	6 months	....	......
Georgia	1 year	6 months	....	......
Idaho	4 months	30 days	....	......
Illinois	1 year	90 days	....	30 days
Indiana	6 months	......	60 days	30 days
Iowa	6 months	60 days	....	10 days
Kansas	6 months	......	....	30 days
Kentucky	2 years	1 year	....	60 days
Louisiana	1 year	......	....	10 days
Maine	3 months	......	....	......
Maryland	1 year	6 months	6 months	......
Massachusetts	1 year	......	6 months	......
Michigan	3 months	......	....	10 days
Minnesota	4 months	......	....	10 days
Mississippi	6 months	1 month	....	......
Missouri	1 year	60 days	60 days	......
Nebraska	6 months	40 days	....	10 days
Nevada	6 months	30 days	....	......
New Hampshire	......	......	6 months	.....
New Jersey	1 year	5 months	....	......
New Mexico	6 months	3 months	....	30 days
New York	1 year	4 months	....	30 days
North Carolina	1 year	30 days	....	......
Ohio	1 year	30 days	....	20 days
Oregon	6 months	90 days	....	......
Pennsylvania	1 year	......	....	2 months
Rhode Island	1 year	......	6 months	......
South Carolina	1 year	60 days	... .	......
Tennessee	1 year	9 months	....	......
Texas	1 year	6 months	....	......
Utah	6 months	......	....	......
Vermont	1 year	.....	3 months	......
Virginia	1 year	6 months	6 months	......
West Virginia	1 year	30 days	....	30 days
Wisconsin	1 year	......	....	......
Wyoming	90 days	......	....	......

NATURALIZATION.

AN alien may be admitted a citizen of the United States in the following manner: —

He shall declare on oath, before a court properly constituted, two years at least prior to his admission, that it is his intention to become a citizen of the United States, and to renounce forever all allegiance to any foreign prince or potentate.

He shall declare on oath that he will support the Constitution of the United States.

He must have resided within the United States at least five years, and within the State or Territory where such court is held one year at least.

He shall also renounce his title, if he held any, in the country from which he came.

Any alien, twenty-one years of age and upwards, who has enlisted, or may enlist, in the armies of the United States, either regulars or volunteers, and has been, or may be, honorably discharged, shall be admitted a citizen of the United States upon his petition, without any previous declaration of his intention to become such; and he shall not be required to prove more than one year's residence within the United States previous to his application to become such citizen.

Any alien, being under twenty-one years, who has resided in the United States three years next preceding his arriving at that age, may, after he arrives at twenty-one years, and after he has resided five years within the United States, including three years of his minority, be admitted a citizen of the United States, without having made declaration above cited.

When any alien who has complied with the first condition (viz., declared his intention) dies before he is actually naturalized, the widow and children of such alien shall be considered as citizens of the United States, and shall be entitled to all rights and privileges upon taking the oath prescribed.

No alien shall be admitted to become a citizen who has not, for the continued term of five years next preceding his admission, resided within the United States.

No alien who is a native citizen or subject or denizen of any country, state, etc., with which the United States are at war at the time of his application, shall be then admitted to become a citizen of the United States.

The children of persons who have been duly naturalized under any law of the United States, or who may have become citizens of any one of the States under the laws thereof, being under twenty-one years at the time of naturalization of the parents, shall, if dwelling in the United States, be considered as citizens thereof; and the children of persons who now are or have been citizens of the United States shall, though born out of the limits and jurisdiction of the United States, be considered as citizens thereof.

Every seaman, being a foreigner, who declares his intention of becoming a citizen of the United States in any competent court, and shall have served three years on board of a merchant vessel of the United States subsequent to the date of such declaration, may, on his application and the production of his certificate of discharge, together with certificate of his declaration of intention to become a citizen, be admitted a citizen of the United States; and said seaman shall, for all purposes of protection as an American citizen, be so deemed after the filing of his declaration of intention to become such.

Naturalization in Canada.—To be naturalized in Canada (by 44 Vict. 13) requires a residence of three years in some British Possession, or a three years' service in some Province under the government. The details of applications for certificates of naturalization are under the control of the Governor General and Council, and the certificates themselves are issued after the proper preliminaries are complied with by the courts of the different Provinces. Besides the regular certificate a special one is sometimes issued to persons about whose being a British subject a doubt has arisen. The children of a naturalized father or widow are held to be naturalized subjects if they were brought there and became residents during infancy. The oath of allegiance is simple. There is a naturalization treaty between the United States and Great Britain which provides for persons who wish to change their nationality.

THE LEGAL FENCE.

Massachusetts. — The legal fence is four feet high. A "sufficient barrier" only is demanded, whether the equivalents be furnished by streams, ditches, live growths, or constructions in wood, stone, or other material.

Vermont and Connecticut. — The legal fence is five and a half feet high, with provisions essentially as above.

Maine and New Hampshire. — The legal fence is four feet high.

Rhode Island. — Stone or wood fences must be four and a half feet high; hedges and ditches are elaborately described.

New York. — The town meetings prescribe what shall be deemed a legal fence in each town. Assessors and commissioners of highways perform the duties of fence-viewers. Four and one half feet is the usual height prescribed.

Pennsylvania. — Towns and counties secure special legislation for fencing railway lines, and to prevent running of the stock at large.

New Jersey. — Fences are to be four feet two inches high, of wood, brick, or stone, and four and a half feet if of other materials.

Delaware. — Four feet, with a ditch within two feet, is a lawful fence. Wood or stone fences, or hedge, four and a half feet high.

Maryland, Virginia, North Carolina, Georgia, Florida, Alabama, Arkansas, Tennessee. — Legal fences, five feet high.

West Virginia. — Legal fences, four and a half feet high.

South Carolina. — Fences must be six feet high, of wood or hedge, or ditches equivalent as barriers.

Missouri. — Hedge five feet, fence four and one half feet.

Kentucky. — "All sound or strong fences, five feet high, so close that stock cannot creep through," is the definition of the legal fence.

Ohio — "A fence, of whatever material, constructed in all respects such as good husbandmen ought to keep." Statute of 1865.

Illinois. — "Fences four and one half feet high, of whatever material the fence-viewers shall deem sufficient."

Michigan. — "Fences four and one half feet high, of rails, timber, boards, stone, or other things deemed equivalent thereto in the judgment of fence-viewers."

Wisconsin. — "Fences four and one half feet high," etc. By act of April, 1878, barbed wire fence is defined as a legal fence.

Minnesota. — "Fences four and one half feet high," etc. Barbed fence defined by the Act of 1877.

Iowa. — "Four and one half feet high, or fifty-four inches." Barbed wire fence prescribed as legal fence, 1876.

Texas. — "Five feet high." Barbed wire defined as legal fence.

Kansas. — "Worm fences four and one half feet; turf, four feet with ditches; wire fence, posts twelve feet apart."

Nebraska. — The legal fence is described as "such a fence as good husbandmen generally keep."

California. — The legal fence is described with great particularity, — wire; post and rail; brush, picket, ditch, and pole, and hedge; wire fences, not less than three separate strands, the first eighteen inches from the ground, the others two and one foot apart.

Colorado, Arizona, Montana, and Utah. — Four and one half feet high.

New Mexico, Idaho, and Washington. — Four feet high.

Washington Territory. — Barbed wire fence must carry a top rail of wood.

Indiana. — Any structure in the nature of a fence, such as good husbandmen generally keep.

Married Women.

AT common law, the married woman had no separate legal existence from her husband. They were two in one, and the husband was the one; for the law made him owner of all the wife's possessions, and she could not make a valid contract in her own right, unless the husband was transported or imprisoned for life. But she might be the agent of the husband, and carry on his business under authority from him; and where the husband is absent from home, she has that authority. And while the relationship exists, the law will assume that she has authority to contract for the necessaries of life, and bind the husband therefor; and in cases where the husband deserts the wife, or enters a religious community which will not permit the continuance of the married state, she becomes, to all intents and purposes, so far as making contracts is concerned, a single woman, and she may sue and be sued on her contracts; and where a divorce — *à mensa et thoro* — has been granted the wife, she may sue the husband for alimony; and for many purposes she stands as a single woman. Where a man holds a woman out to the world as his wife, he becomes liable for her debts, whether they are married or not.

Inasmuch as the laws relative to married women of late years have been undergoing great changes, the tendency of which have been to allow the "femme covert," as the legal savants style her, a greater scope for the exercise of her business abilities, and as there is a wide difference in the statutes of the several States, we have thought it wise to give herewith an epitome of the statutes of the various States and Territories relative thereto. Of course we have condensed the matter into the smallest possible space consistent with a fair understanding of the requirements of the law; and we trust and believe that it is sufficiently explicit to enable our readers to avoid mistakes, and to avail themselves of their rights. Of course, as they say in medical works, in all severe cases a doctor should be called in; but in relation to our matters, the doctor should be one of law and not of medicine.

ALABAMA. — Married women hold, as separate, all property owned at marriage and since acquired, and can be bequeathed or devised by her as if unmarried. Widow is entitled to dower in all lands of which her husband was possessed at death. Women may marry without consent of their parents at eighteen, and attain their legal majority at twenty-one.

ARKANSAS. — A married woman has the same rights, in regard to her property, as if unmarried. In all transactions outside her separate estate, husband must be a party to them. Widow takes half of husband's personal property, and, where there are no children, she takes one half of his real estate for life. Widow also takes dower in one third of all lands of which husband died possessed.

CALIFORNIA. — Married women retain all property owned before, and acquired since, marriage. All property acquired since marriage, except by gift, bequest, devise, or descent, is common property. Widow is entitled to half the common property, after expenses of administration are paid. She can dispose, by will, of her separate estate, without consent of her husband.

COLORADO. — Same as single women. Married women are on the same footing with single women as regards their separate property, except that in devising her property a wife cannot, without husband's consent in writing, bequeath more than half away from him. Widow is entitled to one half of husband's property.

CONNECTICUT. — Since April 20, 1877, married women have the same rights, in regard to all property, as if unmarried. In marriages contracted between June 22, 1849, and April 20, 1879, the personalty vests in the husband as trustee, and in the wife upon his decease. She takes dower in one third of her husband's realty, and he only one half for life as tenant by curtesy. Statute of 1877 gives survivor one third of the estate where there is issue; in case of no issue, one half.

DELAWARE. — Married women (since April 9, 1873) may retain all property acquired before and since marriage (except through husband), and may, with husband's consent in writing, dispose of same by will. In all matters of contract they can act same as if single. If there be no issue. she takes a moiety of the real estate; if there be issue, she takes one third.

FLORIDA. — Property owned by women is not liable for husband's debts; wife must be joined by husband in conveyances of former's property; husband must be joined in suits against her property; wife may dispose of her property by will; widow takes one third of husband's personal property, and dower in life estate in one third part real estate of which husband died possessed. Her property must be recorded within six months after marriage, or subsequent to acquirement. If she dies and leaves no child, the husband takes the whole estate, otherwise the same as a child.

GEORGIA. — Married women retain as separate all the property owned by them previous to marriage and acquired since, and it is not liable for any of husband's debts. The separate estate of wife cannot be bound by any contract of suretyship. Wife may become a free trader by consent of her husband published for one month in a newspaper, and is then liable as if unmarried.

IDAHO. — All property of wife before marriage, and since acquired by gift, bequest, devise, or descent, is her separate property; all other property, acquired after marriage, is common property. The wife's property is liable for all debts contracted before marriage, but husband's separate property is not liable for antenuptial debts of wife.

ILLINOIS. — Married women have the same rights as if single, relative to property, except she cannot enter into a partnership without husband's consent, and both are liable for family expenses. Husband or wife is endowed of the third part of estate whereof deceased was seized. The right of husband and wife in regard to dower is exactly the same.

INDIANA. — Married women retain all property, whenever acquired. She can make contracts, and generally has all the rights of a single woman, except she cannot convey her real estate unless jointly with her husband. She can hold exempt from execution $200 in wearing apparel, and $300 in any other property. Takes one third of husband's real estate, if the estate does not exceed $10,000, and one third of personalty. No dower or curtesy.

IOWA. — Married women have the same rights as their lords relative to their separate property. Husband and wife are both liable for necessaries for the family; but wife is not liable for husband's personal debts, nor he for hers. Of real estate of husband or wife deceased, the survivor is entitled to one third.

KANSAS. — Married women have the same rights in regard to property as men. Widow takes in fee simple one half of all real estate owned by the husband, except homestead, which is the absolute property of widow and children. Property cannot be conveyed by either husband or wife except by their joint deed.

KENTUCKY. — Married women hold property acquired before marriage exempt from attachment for husband's debts. She takes dower in one third for life of all real estate. Husband is responsible for debts of wife contracted before marriage, only to the amount of property received from her at marriage. They can have authority granted them to sue and be sued, by joint petition of husband and wife to Circuit Court.

LOUISIANA. — Wife has sole control of her separate property, but cannot contract debts without consent of husband for their separate benefit. The income of all property acquired by either husband or wife after marriage, and that derived from separate property, is held in common. In husband's real estate wife has no dower. She may carry on business and make contracts. She has also the power of disposing of property by will.

MAINE. — Married women have the same property rights as if single, except where the same is acquired from husband, and at his death they take dower in a life estate in one third of all realty owned by him during marriage. If estate be solvent and no issue, they take half the realty.

MARYLAND. — She has generally the same rights as if single. She can devise by will as if single, but cannot convey except by joint deed with husband. If no children, dower in one half real estate; if children, dower in real estate and one third personal.

MASSACHUSETTS. — Married women enjoy all the property privileges of single women, except as to conveyances to husbands. She may convey her property by will, subject to husband's right of curtesy. If she fails to file certificate with city or town clerk when carrying on business on her own account, her property is liable for husband's debts, and the husband's for the wife's. If no issue, widow takes dower in one half of her husband's real estate, and *in fee* to the amount of $5,000. If a husband dies intestate, and leaves no kindred, his widow takes all his real estate in fee simple.

MICHIGAN. — Married women may retain all the real and personal property they had at marriage and have since acquired, without its being liable for husband's debts. She may sell, convey, or dispose of her separate estate, same as if single. She can give notes binding her separate property, and retains her homestead and common-law rights of dower. Women may marry at sixteen, and are of age at twenty-one.

MINNESOTA. — Married women make, and are bound by, contracts same as if unmarried, since June 1, 1869. She cannot sell her real estate or make any conveyance of land, other than a mortgage for the purchase money or a lease for three years or less, without husband joining in the conveyance. Surviving wife or husband is entitled to the homestead for life, free from debts of deceased, and to one undivided third of all other lands of which deceased was possessed during coverture.

MISSISSIPPI. — All property owned by women before marriage and since acquired, except through her husband, is held by her as separate and exempt from claims against husband, but is liable for wife's antenuptial debts. Wife is liable for supplies for household when she engages in business as a trader. Widow is entitled to entire real and personal estate when husband dies intestate. She takes dower in one third of all his lands if there are children, and one half in fee simple if there are none.

MISSOURI. — Married women have generally the same rights as single, except that if a woman trade through the intervention of trustees, her property is liable for husband's debts. She takes dower for life in one third of all the husband's lands; cannot act as executrix or administratrix.

Montana. — The property of married women is exempt from liabilities of husband, except for necessary household expenses. A list of her property must be filed with the recorder of the county of which she is a resident.

Nebraska. — All property owned by wife at time of marriage or acquired by her since, except through her husband, is her separate property. In relation to said property she has all the rights and privileges of a man. In all matters of business carried on her separate account, she may sue and be sued. Widow takes dower of one third part of all lands of which husband died possessed during *her natural life.* Women cannot become sureties or guarantors for husband.

Nevada. — All property acquired by wife, by gift, bequest, devise, or descent, or owned by her previous to marriage, is separate property; all property otherwise acquired during marriage is common property, but controlled by husband.

New Hampshire. — Married women may retain and own property, and make contracts in relation to it, except that acquired through husband. They are liable for debts contracted before marriage, and cannot become sureties or guarantors for their husbands· may make a will, subject to husband's right of curtesy.

New Jersey. — The rights of married women to hold real and personal estate are the same as though unmarried. She cannot convey her real estate without her husband, nor can she be his surety or guarantor. She has a right to dower in one third of husband's real estate, and also a share of his personal property. In all mortgages given by husband, wife must join. She may carry on trade and make contracts, and sue and be sued in her own name, and make a will subject to husband's rights.

New York. — Married women have all the rights and privileges of single persons relating to their property. When, in any contract or instrument, there is expressed an intention to charge the separate estate, the liability may be enforced against married women. Right of dower in full. May dispose of property by will.

North Carolina. — Married women hold as their separate estate all property acquired before and since marriage. They are not liable for debts contracted during coverture. Widows have a year's allowance out of their husband's personal property, and have dower of one third of his real estate; unless a free trader, must have husband's consent to enter into contracts. Husband cannot sell or lease her property unless she consents. May make a will, subject to husband's right of curtesy.

New Mexico. — Married women cannot contract for the sale of real estate except husband joins in the conveyance.

Ohio. — Married women retain all property acquired before or since marriage as their separate property. They cannot sell or mortgage real estate except by husband joining in the conveyance. She can lease her real estate for a term not exceeding three years, and can make contracts for its cultivation or improvement She is entitled to dower in all real estate of husband owned during marriage, and, if no issue, has a life interest in whole estate. A woman arrives at legal age at eighteen years.

Oregon. — Married women retain all property free from liabilities of husband. May carry on any business, make contracts, and give notes Her property is liable for all claims against her. Can dispose by will of her real estate, subject to husband's rights as tenant by curtesy.

Pennsylvania. — All property, no matter when or how acquired, can be held as her own separate property, and not liable for debts of husband. Her separate estate can be levied on for necessaries contracted by her for her family. Her husband must join her in deed conveying real estate. Her earnings belong to husband, and she takes dower, as a widow, in one third of all his realty.

Rhode Island. — Married women cannot carry on any trade or business. Their property is exempt from husband's liabilities, and is secured to their separate use. They have full rights of dower and curtesy.

SOUTH CAROLINA. — Married women have a right to all real and personal property acquired either before or since marriage, and cannot be levied on for husband's debts. She has the same rights in regard to conveyance and devising of property as if she were single.

TENNESSEE. — The personal property of the wife is exempt from control of the husband, and cannot be attached for his debts. Her ordinary commercial contracts are void. A joint note with her husband does not bind her. If husband dies intestate and without heirs, wife takes his entire real estate absolutely, after his debts are paid; otherwise she takes dower in one third of his lands. Of his personal property she takes one third, but only a child's part if there be more than two children. May dispose of her property by will.

TEXAS. — Married women retain all property owned by them before and since marriage, without being liable for husband's debts. Separate estate liable for necessaries for wife and children, and for expenses incurred for their benefit. Husband cannot sell or convey any part of wife's estate without her consent.

UTAH. — The separate property of women is theirs absolutely, whether acquired before or since marriage. In all matters pertaining to wife's separate property, she can act as if unmarried.

VERMONT. — Married women are not responsible for debts of their husbands, and can hold their property separate from them. They cannot convey real estate without husband's consent, but can make such disposition of real and personal property by will as they may elect. At death of husband they take dower in one third of all his real estate. Cannot make contracts save when husband is absent, or by order from court.

VIRGINIA. — Any property owned or acquired by married women since April 4, 1877, as a separate trader, is exempt from the control and liability of husband. Widow is entitled to dower as at common law. Where she is not a separate trader, husband must join in all contracts, and be joined in any suit. She may dispose of her property by will, subject to husband's right of curtesy.

WEST VIRGINIA. A married woman may retain all property, free from husband's control or liabilities. She must be joined by husband in conveyance of realty. She is entitled to dower in one third of all the real estate of her husband during coverture, except she has legally relinquished such claim. She may make a will.

WISCONSIN. — Are entitled to hold property acquired from sources other than her husband. Property thus held is not liable for husband's debts. She may dispose of her property same as if unmarried. The husband is not liable for debts contracted by wife before marriage, where marriage took place since April 3, 1872. She can sue alone, but, when sued, husband must be included. Wife can make any business contract with husband. Widow is entitled to a dower of one third life interest in all lands owned by husband during marriage.

WYOMING. A married woman can carry on any business, and make contracts as if she were single. Her property is not liable for husband's debts. She can sue and be sued, and has also the right to make a will.

CANADA. — The property and earnings of a married woman are not subject to the control of her husband. It is liable for her ante-marriage debts, and her husband is not. She may manage and bequeath it, and is entitled to dower, but tenancy by curtesy does not obtain. This law is modified somewhat in the Province of Quebec by the French law. In the latter place the personal property and gains of husband and wife are held in common, and are administered by the husband. Each can bequeath only their individual interest, and the heirs of each inherit in acordance therewith.

LIENS.

A LIEN is a claim or hold which a person has upon the estate or goods of another for services rendered or materials furnished. In every case in which property, either real or personal, is charged with the payment of a debt or duty, every such charge may be denominated as a lien on such property. A general lien is the right to retain the property of another for a general balance due from the owner. A particular lien is the right to retain the property of another on account of services performed or money expended on a specific article. A general lien includes, as a matter of course, particular liens. Every mechanic has a particular lien on every article on which he expends labor or money. Carriers also have a lien on all goods consigned them for services rendered. Lawyers have a lien on all the papers in a case for their pay. Pawnees have a right of lien where the pawnor has authority to pledge, but not otherwise. All vendors have a lien on goods sold, but not delivered, for their pay. Factors' agents and brokers have a general lien for commissions due.

The essential requisite of a lien is, the lawful delivery of the property to the party claiming the lien, or his agent. The lien is lost by voluntarily parting with the possession of the chattel. A creditor has a lien on goods sufficient to retain possession of them even against assignee of debtor, provided the same have not been placed in his possession to defraud other creditors. Seamen have a lien on freight and vessel for their wages, and the proceeds thereof. But sailors in the service of the government have no lien on government vessels. Shippers of goods have a lien for the value of the goods shipped; but stevedores have no lien. The statutes of the different States give mechanics and material men a lien on real estate for labor and materials furnished; and as the statutes are not uniform, we give an abstract of all the lien laws of the different States.

ALABAMA. — Laborers and others have a lien for work done and materials furnished. The original contractor must file in the probate court his claim for lien within six months; workmen, within thirty days. Suit must be brought within ninety days.

ARIZONA. — All mechanics and others performing labor or furnishing material for the repair or construction of any building, or for work done upon any lode or mining claim, shall have a lien on the same for the labor done or material furnished. Notice must be filed within ninety days in recorder's office, verified on oath, containing account of the demand due. If such lien be claimed by a sub-contractor, the account aforesaid shall be filed within six days from completion of work. Suit must be brought to enforce lien within six months, and no lien shall be continued in force for a longer time than two years.

ARKANSAS. — Any one who has performed work or furnished materials towards the erection or repair of any building has a lien on same, and on the land on which it stands. An account must be filed within three months in the Circuit Court. Suit must be begun within nine months thereafter.

CALIFORNIA. — Laborers and mechanics have a lien on buildings for materials supplied or work done. Suit must be brought within three months, and claim filed within thirty days, except the original contractor, who has sixty days.

COLORADO. — Mechanics or laborers performing work or furnishing materials for any building to the amount of over twenty-five dollars may have a lien thereon. Suit to enforce lien must be commenced within six months from date of filing same. The lien of sub-contractors must be filed within twenty days after completion of work; principal contractors, in forty days.

CONNECTICUT. — Labor performed or materials furnished by mechanics or laborers, to an amount exceeding twenty-five dollars, for the erection or repair of any building or a railroad, entitles to a lien on said building or railroad, and the land on which they stand. The premises may be foreclosed, as with a mortgage, and a claim must be lodged within sixty days. Work done on, or materials furnished for, a vessel, subjects it to a lien, if claim be filed ten days from the completion of the work.

DAKOTA. — No person is entitled to a mechanic's lien who takes collateral security on the same contract. All persons furnishing materials for, or performing labor on, any building, have a lien on the same, and also on the land on which it stands. Notice must be duly filed within ninety days, and verified by affidavit containing amount of demand due, and description of property.

DELAWARE. — A lien may be obtained by any person who has performed work, or furnished materials, to an amount exceeding twenty-five dollars. Claim must be filed within six months from completion of work.

FLORIDA. — Mechanics have a lien on the building, and the lot on which it stands, for materials furnished or labor performed. Laborers have a lien on the crops on which they worked, for the amount of their wages. Contracts must be in writing, signed and recorded, to give right to lien. Claim must be filed within six months, and suit brought within twelve months, after work is finished.

GEORGIA. — Mechanics and others have a lien on the buildings erected or repaired by them. The lien must be recorded in the clerk's office of the county in which the land is situated, within thirty days, and it must be enforced by a suit within twelve months.

IDAHO. — All mechanics and laborers who furnish materials or perform labor to the amount of twenty-five dollars, for the construction or repair of any building, shall have a lien on the same; also on the land on which it is situated, if it belongs to the person who caused the building to be erected. Notice must be filed in recorder's office within sixty days from completion of the work, with account of demands due, verified by affidavit. Lien expires in six months unless suit is brought. The act includes in its provisions work or labor in or upon any quartz or claim, mine, or ledge.

ILLINOIS. — Persons have a lien on the building and lot for work done and materials furnished. Suit to enforce lien must be commenced within six months from completion of work.

INDIANA. — Mechanics and others have a lien on buildings or other property for work done or materials furnished. Notice must be filed within sixty days, and suit brought within one year, from completion of work.

IOWA. — Laborers and mechanics have a lien upon the land and buildings for which they have furnished labor or materials. Liens for labor alone are exempt from execution and are assignable. Claim must be filed within ninety days, and suit begun within two years.

KANSAS. — Laborers and mechanics have a lien upon the land and buildings for which they have furnished labor or materials. Claims must be filed within four months in the Circuit Court, and enforced by suit within one year, except by sub-contractors, who must file claim within sixty days.

KENTUCKY. — Mechanics and laborers, for materials furnished or work done, have a lien upon the improvement, and interest of the owner in the land. It may be enforced by a suit brought within six months from the filing of the account or claim, which must be done within sixty days from the completion of the work. Laborers and sub-contractors must give written notice to the owner that they intend taking advantage of the lien law.

LOUISIANA. — Persons furnishing labor or materials for erection or repair of a building have a lien on the same. The seller retains a lien on the property by him sold, for the payment of the price. Liens must be recorded in the parish where the property is situated. Liens in this State are called privileges.

MAINE. — Mechanics have a lien on buildings for materials or labor furnished, and may enforce same within ninety days by suit and attachment. Boat-builders have a lien on the vessel repaired or built, and lumbermen on the logs on which they work.

MARYLAND. — For work done or materials furnished towards the erection or repair of any building, gives a lien on such building to the extent of one fourth of its value; also on machines or vessels built or repaired. Claim must be filed in the Circuit Court of the county or the Superior Court of Baltimore, and the lien expires in five years; in case of vessels it expires in two years. The counties of Kent, Calvert, Charles, and St. Mary's are exempt from these laws, except as they apply to boats or vessels.

MASSACHUSETTS. — Mechanics and laborers have a lien on buildings which they erected or repaired, for the labor and material furnished, and also a lien on the lot of land on which such buildings are erected. Suit must be commenced within ninety days, and claim filed within thirty days, from completion of the work. Where the owner of the property is not a party to the contract, a lien for materials will not attach, unless owner has previous notification in writing.

MICHIGAN. — Mechanics and others have a lien upon the land and buildings for which they have furnished labor or materials. At the expiration of six months from the time the debt becomes due the lien ceases, unless enforced by a petition in chancery. A copy of contract must be filed with the register of deeds in order that lien may attach. The person having the lien may sue the owner and contractor jointly.

MINNESOTA. — Persons furnishing material or performing work on any building have a lien on such building, and on the land on which it is situated, not exceeding forty acres if without, or half an acre if within, a city or village. The lien runs for two years, and an account must be filed with the register of deeds within one year.

MISSISSIPPI. — Any one has a lien on property, land, etc., for materials supplied or work done. Liens must be enforced within six months by suit. Lien takes effect upon filing the contract in the Court of Chancery.

MISSOURI. — Persons doing work or furnishing materials on any property have a lien on the same, and the land on which it stands. Liens may be enforced in the Circuit Court, where they must be filed in the clerk's office. Claims must be filed as follows: Original contractors', six months; mechanics' and laborers', thirty days. And suit must be brought within ninety days after filing.

MONTANA. — Every mechanic or other person who performs any work or furnishes any material for any building, ranch, mining claim, or quartz lode, shall have a lien on such property, and on the land on which they are situated. Sub-contractors must file notice of their claim with recorder within thirty days from completion of work; all others, within sixty days. Any ranchman or farmer to whom any cattle shall be intrusted, and a contract made for the purpose of feeding, herding, etc., may retain possession of such cattle till amount due for such is paid. The provisions of the act do not apply to stolen stock.

NEBRASKA. — Any one has a lien upon a building or other property for which he has furnished labor or materials. The lien is obtained by filing in the county clerk's office a detailed statement of account within four months after completion of the work. The lien is valid from the date of the first item till two years after the date of the last item.

NEVADA. — Any person has a lien on a building towards which they have furnished materials or performed work, whenever their claim exceeds twenty-five dollars. The lien must be recorded by original contractor within sixty days from completion of the work, and by all others within thirty days, and runs only six months unless suit is commenced.

NEW HAMPSHIRE. — Mechanics, laborers, and others furnishing materials have a lien on the buildings, and the land on which they stand. Said lien runs for ninety days and takes precedence of all attachments. Laborers have a like lien on the lumber which they may be employed in cutting; and laborers on vessels have a lien which can be enforced by attachment, and which runs four days after the vessel is completed.

NEW JERSEY. — Mechanics and laborers furnishing materials for, or performing labor on, any building, have a lien on same, and also on the lot on which it stands. When the contract upon which a building is erected is duly filed, the contractor only has a lien. Claim must be filed and suit brought on the same within one year.

NEW MEXICO. — Every person performing labor or furnishing material for the repair or construction of any building, mining claim, or railroad, or any other structure, or who performs labor in any mining claim, shall have a lien upon the same, also upon the land on which it is situated, if it belong to the party having the work done. Every original contractor must within ninety days, and every other person within sixty days, file their claim, verified on oath with county recorder. Suit must be commenced within one year, and no lien continues in force for a longer time than two years.

NEW YORK. — Laborers and contractors furnishing materials or labor for the erection or repair of any building have a lien on the property for the amount of their claims. It can be enforced by suit within one year, and notice must be filed within sixty days to three months after the completion of the work.

NORTH CAROLINA. — Persons furnishing materials or performing work in the erection or repair of any building, or the improvement of land, have a lien on the said building and land. Same rule applies to any article of personal property.

OHIO. — Mechanics have a lien on all property erected or repaired by them, and on the land on which it is situated. An account in detail must be filed of record within four months from completion of such labor, and the lien runs for one year, or until a suit commenced within the year to enforce it is finally settled.

OREGON. — Mechanics and laborers have a lien on the building, and land on which it is situated, towards which they have furnished materials or performed work, if the amount exceeds twenty dollars. Claim must be filed within three months and suit brought within one year.

PENNSYLVANIA. — Mechanics have a lien on all buildings built and repaired by them. The claim is valid for five years, and must be filed in the Court of Common Pleas within six months. The wages of mechanics and others, in a sum not exceeding two hundred dollars, is a lien upon the manufactory or other property.

RHODE ISLAND. — Mechanics, laborers, and others have a lien for work or material furnished for the construction or repair of any building, on said building and the land on which it stands, provided the claim is filed with town clerk, and suit is brought upon the same, within four months.

SOUTH CAROLINA.—Any person furnishing labor or materials for the erection and repair of any structure has a lien upon the same, and the land on which it stands. The claim must be filed within thirty days after the completion of the work, and suit on the same brought within ninety days. A lien for materials will not be allowed unless the owner be given notice in writing, except he be a party to the contract.

TENNESSEE.—Persons have a lien on the buildings, ground, and improvements for work done and materials furnished, for one year; and, if agreement has been made with mortgagor with mortgagee's consent, the lien takes precedence of the mortgage. Landlords have a lien on the crops for rent of land, and on growing crops for necessaries supplied. Sub-contractors and workmen must notify owner before commencing work if they intend to claim lien.

TEXAS.—Mechanics and others have a lien upon the buildings, and the land upon which they are erected, if the contract is written and recorded within six months. Landlords have a lien for necessaries furnished tenant to enable him to raise a crop.

UTAH.—Any person who performs any labor or furnishes any material for the construction or repair of any building or other improvement shall have a lien upon such building or improvement, and the right of possession of the ground upon which the same is situated. Notice must be filed with the recorder within three months from completion of the work. A lien shall cease to exist after one year from completion of work if suit be not commenced to enforce claim.

VIRGINIA.—Persons furnishing materials or performing work, for the erection or repair of any building, have a lien on the property, and the land on which it stands.

WASHINGTON TERRITORY.—Mechanics or laborers who perform any work or furnish any material for the repair or construction of any building have a lien thereon, as also on the land on which it stands. Notice of claim, must be filed within sixty days from completion of work, with the county auditor, verified by affidavit.

WEST VIRGINIA.—Mechanics and laborers furnishing materials or performing work, for the erection or repair of any building, have a lien upon the building and the land on which it stands. A statement of account and description of property must be filed with the clerk of the county court within thirty days from completion of work. The lien must be enforced within six months by a suit in chancery.

WISCONSIN—Persons performing labor or furnishing materials for the erection or repair of any building have a lien on the building, and on the land to the extent of forty acres in the country.

WYOMING.—Any mechanic or other person, who performs any labor or furnishes any material for the repair or construction of any building or other property, shall have a lien on the same, and on the land on which it stands. Notice must be filed with register of deeds within sixty days from completion of work, and shall operate as a lien for one year thereafter.

Province of Quebec.—Mechanics' Liens.—Builders, workmen, and architects have a lien on the additional value resulting from their work. An official statement of the state of the premises must be made previously by an expert appointed by the court, and within six months the work must be accepted by another expert.

Province of Ontario.—Mechanics' Liens.—Builders, mechanics, miners, contractors, or machinists have a lien to the extent of the owner's interest on both land and buildings. The lien must be registered within one month of the completion of the work, in the county register's office.

Nova Scotia.—Mechanics' Liens.—The act of 1879 establishes liens in favor of mechanics, machinists, contractors, and sub-contractors. A statement of claim and the written contract must be registered. Disputed claims of sub-contractors may be settled by arbitration. The registry must be made within thirty days of the time when the work was done or materials furnished. If suit is not brought within ninety days after the claim is registered, the lien expires.

Mechanic's Lien.

COMMONWEALTH OF ....

.... *hereby certify that the following is a just and true account, with all just credits given, of the amount due* .... *for*[a] .... *in the*[b] .... *of a building on a lot of land in* .... *in said Commonwealth, which lot is described as follows* [give description of premises so as to identify]; *said lot of land being owned, to the best of my knowledge and belief, by* ....

ACCOUNT.

...., *Dr.*

To ....

	$

.... *further certify that* .... *ceased to* [c]..................... *said building on the* .... *day of* .... *A. D.* ... , *and that* ...., ... *and* .... *hereby claim a lien upon said building, and upon the interest of the owner thereof in the lot of land upon which it stands, to secure the payment of the debt due* ....*as aforesaid, and of the costs which may arise in enforcing said lien.* *(Signatures.)*

....

....

State of..................

.... *ss.* ...., 18...

Then personally appeared the above-named .... *and made oath that the foregoing certificate, by* ... . *subscribed, is true.*

Before me,

....,

Justice of the Peace.

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[a] Here insert "labor performed" or "materials furnished and actually used."

[b] Here insert "erection," "alteration," or "repair."

[c] Here insert "perform labor on," or "furnish labor for," or "furnish materials for."

Abstract of Pension Laws.

EVERY person who has been, since the 4th of March, 1861, disabled in the military or naval service of the United States, or in its marine corps, shall, upon making due proof of the fact, be placed on the list of invalid pensioners of the United States. No claim for pension on the part of a State militia-man, or non-enlisted person, on account of disability from wounds received in battle, shall be valid unless prosecuted to a successful issue prior to July 4, 1874.

RATES OF PENSION PER MONTH.

Specific Disabilities.	Rate from July 4, '64.	Rate from Mar. 3, '65.	Rate from June 6, '66.	Rate from June 4, '72.	Act of June, '80.*
Loss of both hands	$25 00	.....	.....	$31 25	$72 00
Total disability in both hands	.....	.....	$25 00	31 25	.....
Loss of both feet	20 00	.....	.....	31 25	72 00
Total disability in both feet	.....	.....	20 00	31 25	.....
Loss of sight of both eyes	25 00	.....	.....	31 25	72 00
Loss of sight of one eye, the sight of the other having been previously lost	.....	.....	25 00	31 25	72 00
Loss of one hand and one foot	.....	$20 00	.....	24 00	36 00
Total disability in one hand and one foot	.....	.....	20 00	24 00	.....
Any disability equivalent to the loss of a hand or foot	.....	.....	15 00	18 00	.....
Any disability incapacitating for the performance of any manual labor	.....	.....	20 00	24 00	.....
Any disability resulting in a condition requiring the regular aid and attendance of another person	....	.....	25 00	31 25	From June 4, '74, 50 00
Total deafness	.....	.....	.....	13 00	.....

PENSION LAWS.

The same provision of law which entitles to $31.25 per month entitles to $72.00 per month, provided that in the latter case the disability is permanent. The loss of a leg above the knee, or an arm at or above the elbow, entitles the person so disabled to a pension of $24.00 per month, after June 4, 1874.

The rates of $10.00, $12.00, $14.00, and $16.00 per month will be allowed in cases in which the disability bears the same proportion to that produced by the loss of a hand or foot that those rates bear to the rate of $18.00 per month. Rate for "total disability" is $8.00 per month.

The phrase "total disability" is construed to refer to a total disability for the performance of manual labor requiring severe and continuous exertion. The phrase "any manual labor" is construed to include the lighter kinds of labor which require education and skill.

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* Rate from June, 1880, in case the disability is permanent and requires the regular aid and attendance of another person.

An applicant for increase of pension from $31.25 to $72 per month must furnish the testimony of his physician, or of two credible witnesses, to prove the extent to which he requires the aid and attendance of another person.

The first step to be taken by an applicant for pension is to make a declaration before a court of record, or before some officer thereof having custody of its seal, setting forth the ground upon which he claims a pension. Blank forms of declaration are furnished upon request made to the Commissioner of Pensions. The identity of the applicant must be shown by the testimony of two credible witnesses, who must appear with him before the officer by whom the declaration may be taken. A pensioner who may deem himself entitled to an increase of pension should file a declaration on blank form furnished for the purpose, setting forth the ground upon which he claims such increase. A declaration for increase of pension may be taken before any officer duly authorized to administer oaths for general purposes.

All invalid pensions granted under the general law will terminate at re-enlistment, or when the disabilities for which they were allowed shall have ceased.

A widow's pension will end at her re-marriage, and not be renewable should she again become a widow.

Pensions allowed to dependent mothers and sisters end at re-marriage, or when dependence ceases. Pensions allowed to dependent fathers end when the dependence ceases.

The name of any pensioner shall be stricken from the roll upon his or her failure to claim a pension for three years after the same shall have become due.

To entitle a widow or children to pension, the death of the husband or father must have been the result of injury received, or disease contracted, under such circumstances as would have entitled him to an invalid pension had he been disabled.

A widow is entitled to a pension of the same rate as that to which the husband would have been entitled had he been totally disabled. In addition to this rate, she will be allowed $2.00 per month for each child of the officer or soldier under the age of sixteen years.

In the applications of widows and children for pensions, they will be required to prove that death of husband resulted from the injury or disease on account of which his pension was granted; and, if husband had not established his claim for an invalid pension, widow shall prove origin and cause of the fatal disease. Widows will be required to prove their marriage to the person on account of whose service and death the claim is made; also to furnish proof of dates of birth of children, by copy of church record, or equivalent evidence.

A mother claiming a pension must prove the cause and date of the death of her son; her relationship; that he left no widow or minor child or children surviving; and her dependence upon him for support.

A father claiming pension on account of the death of his son, upon whom he was dependent for support, must prove facts similar to those required of a mother.

The claim on behalf of minor brothers and sisters should be made by a guardian duly appointed.

In administration of the pension laws, no distinction is made between brothers and sisters of the half blood and those of the whole blood. Evidence in a claim for pension cannot be verified before an officer who is engaged in the prosecution of such claim.

FEES.—In an original claim for pension, any fee within the legal limit of $25.00, that may be agreed upon by the claimant and attorney, will be allowed.

In claims for increase of pension, a fee of $10.00 will be allowed. All letters of inquiry relative to claims pending in Pension Office should give the number of the claim.

The failure of any pensioner to claim his pension for three years after the same shall have become due, shall be deemed presumptive evidence that such pension has legally terminated, by reason of the pensioner's death or otherwise; and his name shall be stricken from the list of pensioners, subject to the right of restoration to the same on a new application.

Every person who knowingly or wilfully procures the making or presentation of any false or fraudulent affidavit concerning any claim for pension, or pertaining to anything within the jurisdiction of the Commissioner of Pensions, shall be punished by a fine not exceeding $500, or by imprisonment for a term not exceeding three years, or both.

No sum of money due, or to become due, to any pensioner, shall be liable to attachment, levy, or seizure, under any legal or equitable process.

Agents for paying pensions shall receive two per centum on all disbursements made by them to pensioners.

No agent, or attorney, or other person, shall demand or receive any other compensation for his services in prosecuting a claim for pension or bounty-land than such as the Commissioner of Pensions shall direct to be paid to him, not exceeding $25.00.

Every officer, or enlisted or hired man, who has lost a limb, or the use of a limb, in the military or naval service of the United States, is entitled to receive, once every five years, an artificial limb or apparatus, or commutation therefor. The period of five years is reckoned from the filing of the first application after June 17, 1870. The commutation allowed in case of the amputation of a leg is $75.00; in all other cases, $50.00. Applications for artificial limbs should be transmitted through the proper pension agent to the surgeon-general of the army.

EXEMPTION LAWS.

STATES AND TERRITORIES.	Value of Personal Property.	Acres of Land.	Value of Homestead.
Alabama	$1,000	160	$2,000
Arizona	900	...	5,000
Arkansas	500	160	2,500
California	900	...	5,000
Colorado	800	Any number.	2,000
Connecticut	500	...	×
Dakota	1,500	160	×
Delaware	200	...	...
District Columbia	...	...	...
Florida	1,000	In country, 160	...
Georgia	No waiver. 300	...	1,600
Idaho	...	...	*
Illinois	300	...	1,000
Indiana	600	...	×
Iowa	200	40	No limit.
Kansas	800	160	No limit.
Kentucky	200	...	1,000
Louisiana	...	...	2,000
Maine	About 300	...	500
Maryland	100	...	×
Massachusetts	About 450	...	800
Michigan	400	40	1,500
Minnesota	$800	80	...
Mississippi	550	80	$2,000
Missouri	300	160	1,500
Montana	900	. .	5,000
Nebraska	...	160	2.000
Nevada	900	...	5,000
New Hampshire	About 450	...	500
New Jersey	200	...	1,000
New Mexico	900	...	5,000
New York	250	...	1,000
North Carolina	500	...	1,000
Ohio	100	...	1,000
Oregon	175	...	×
Pennsylvania	300	...	×
Rhode Island	500	...	×
South Carolina	500	...	1,000
Tennessee	1,200	...	1,000
Texas	...	200	5,000
Utah	...	...	1,000
Vermont	200	...	500
Wash. Territory	*	*	*
West Virginia	200	...	1,000
Wisconsin	450	40	...
Wyoming	900	...	5,000

× No homestead law.

* Very near same as California.

Ontario. — The following are extracts from "An Act to exempt certain articles from seizure in satisfaction of debts," being 23 Vic., cap. 25, and the amending statute being 24 Vic., cap. 27 : —

The following chattels are hereby declared exempt from seizure under any writ issued out of any court whatever in this Province.

The bed, bedding, and bedsteads in ordinary use by the debtor and his family; the necessary and ordinary wearing apparel of the debtor and his family; one stove and pipes, and one crane and its appendages, one pair of andirons, one set of cooking utensils, one pair of tongs, and shovel; one table, six chairs, six knives, six forks, six plates, six teacups, six saucers, one sugar basin, one milk jug, one teapot, six spoons, all spinning wheels and weaving looms in domestic use, and ten volumes of books; one axe, one saw, one gun, six traps, and such fishing nets and seines as are in common use; all necessary fuel, meat, fish, flour, and vegetables actually provided for family use, not more than sufficient for the ordinary consumption of the debtor and his family for thirty days, and not exceeding in value the sum of forty dollars; one cow, four sheep, two hogs, and food therefor for thirty days; tools and implements of, or chattels ordinarily used in the debtor's occupation to the value of sixty dollars. The debtor may select out of any larger number the several chattels exempt from seizure under this act.

Quebec. — The same as Ontario, with the addition of fifteen hives of bees, except that the food exempt for the family must not be of greater value than twenty dollars, and the tools or implements must not exceed thirty dollars in value.

New Brunswick. — The exemptions are wearing apparel and kitchen utensils to the value of sixty dollars.

Nova Scotia. — The exemptions are wearing apparel and kitchen utensils not to exceed in value forty dollars.

NOTES.

Alabama. — Waiver of such exemption is not valid unless joined in by wife.

Arizona. — Very near same as California.

Arkansas. — Single persons, and not heads of families, have property valued at $200 besides wearing apparel exempted.

California. — (Homestead of single person, valued at $1,000, is exempt.) Sluices, pipes, tools, etc., necessary for business, $500; two horses or mules with harnesses, and miners' claim, $1,000; earnings within thirty days, if necessary for family's support; shares in homestead associations, $1,000, if debtor has no selected homestead; life-insurance policies and benefits to $500. All things mentioned are not exempt for purchase-money.

Colorado. — Persons not heads of families have exempt, tools, working animals, stock, etc., to the value of $300.

Connecticut. — One cow, ten sheep, two swine, and provisions, trade tools, etc., and horse, harness, and buggy, if doctor; or boat, not exceeding $200, if fisherman. Benevolent societies' benefits, pensions, and salaries to amount of $10 for single man and $25 for married man, are also exempt except for board.

Dakota. — Lot in town, city, or village, of six acres, tools, etc., of mechanic, $200: and books and instruments of professional men, $600, — are exempt from taxation.

Delaware. — Family pictures, Bible, and library, lot in burial-ground, church pew, all wearing apparel and tools to the amount of $75.

Florida. — Residence and one half acre of ground in city or village; laborers, heads of families, and residents have their wages exempt. No property is exempt from its purchase-money or taxes.

Georgia. — Taxes, purchase-money, labor done on homestead or material furnished therefor, are all exempted.

Idaho. — All necessary household furniture, provisions sufficient for three months; two cows with their sucking calves, and two hogs with their sucking pigs; two horses or oxen, one cart or wagon; and all seed necessary for planting not exceeding $200 in value; the tools of a mechanic not exceeding $500 in value; shares held by a member of an incorporated homestead association not exceeding in value $1,000.

Illinois. — One hundred dollars' worth of selected property, besides necessary wearing apparel, Bibles, school-books, and family pictures, are allowed to every member of family; wages to the amount of $50 are exempt when debtor is head of family. Exceptions are for wages of laborer or servant.

Indiana. — (See table.)

Iowa. — Within town homestead and one half acre of land Homestead passes to the survivor upon decease of husband or wife. Stock and food for six months, pew in church, lot in burying-ground, libraries, instruments, etc., of professional men, and team and wagon; press and type of printer, to $1,200. Unmarried persons and non-residents not heads of families have only their ordinary wearing apparel, and trunk to contain same, exempt.

Kansas. — One acre in town, with building also, of unlimited value; family Bible, school-books and library, family pictures and musical instruments, all wearing apparel, all family beds and bedding, one cooking-stove and all cooking utensils, and all other stores necessary for debtor and family; one sewing machine, spinning wheel, and all implements of industry; two cows, ten hogs, two oxen, one horse or mule, twenty sheep and their wool; food for support of stock for one year, food for support of family for one year; table and implements necessary for carrying on any business; and, in addition, stock in trade to $400, library, etc., of any professional man.

Kentucky. — Applies to *bona fide* housekeepers with a family: necessary household furniture, live stock, provisions and provender, agricultural and domestic implements, libraries and instruments of professional men, to $700; laborers' wages to amount of $50, except for family supplies and house-rent. Exemption continues after decease of debtor for widow and infant children, if any.

Louisiana. — No exception if wife has separate property to the amount of $2,000.

Maine. — Homestead must be registered.

Maryland. — Besides wearing apparel, books, and tools necessary for use; exceptions are for judgments for breach of promise to marry and seduction. Choses in action may be attached.

Massachusetts. — Homestead must be recorded. Besides stock amounting to $100; boats, fishing tackle, etc., to $100; one cow, six sheep, one swine, and two tons of hay; sewing machine, necessary wearing apparel, church pew, etc.

Michigan. — Wife's consent to sale or incumbrance of homestead necessary; and two cows, five swine, ten sheep, span of horses or mules, tools, etc., one sewing machine, fuel and provisions, etc., for six months.

Minnesota. — If in city of less than 5,000 inhabitants, half an acre. If in larger city, etc., one lot and dwelling-house thereon, of no limited value, besides three cows, ten swine, twenty sheep and wool, yoke of oxen and horse, or two horses or mules; food for stock for one year; 150 bushels of seed grain, and family provisions for one year; tools, etc., of miners, mechanics, etc., and trade stock of $400 in value; professional men's library and instruments, $20 of laboring man's or woman's wages for services rendered ninety days previous to issue of process. If debtor is a printer, all presses, etc., not exceeding $2,000 in value, and stock in trade valued at $400, are exempt.

Mississippi. — Lot and residence in city, etc., besides tools, implements for farming and necessary wearing apparel, sewing machine, two cows and calves, two horses or mules; or, in lieu of, one yoke of oxen, five sheep, five swine, with food and provisions.

MISSOURI. — In city, etc., of less than 40,000 inhabitants, thirty square rods; in city, etc., of over 40,000, eighteen square rods, valued at $3,000.

MONTANA. — Same as California.

NEBRASKA. — Two contiguous lots in city, etc., exceptions are on debts secured by mechanics, laborers, or vendors' liens on the premises, and on debts secured by mortgage thereon, executed by both husband and wife or an unmarried claimant. If debtor has no lands, he may claim necessary furniture, clothing, supplies for family for six months, certain domestic animals, tools, implements of trade, etc., and sixty days' wages of clerk or laborer.

NEW HAMPSHIRE. — One pig or pork of same, one cow, one hog, six sheep and wool, one sewing machine, one yoke of oxen or one horse, and four tons of hay.

NEW JERSEY. — Except on a judgment for purchase-money.

NEW YORK. — Debtors' earnings for sixty days previous to issue of process (if necessary, wholly or partly, to the support of family) are exempt.

NORTH CAROLINA. — Any lot in city, etc., with dwelling thereon, owned and occupied by any resident of State, of same value. This law is not applicable to debts contracted prior to Aug. 20, 1868, or taxes, payment of purchase-money, or laborers' or mechanics' liens.

OHIO. — If debtor be the head of a family not owning a homestead, he may hold other personal property not exceeding $500 in appraised value, food for certain domestic animals for sixty days, and provisions valued at $60.

OREGON. — If debtor be head of a family, domestic animals, household goods, utensils, and furniture to the value of $300. When judgment is issued for purchase-price, no article of property is exempt from execution.

PENNSYLVANIA. — Books, clothing, sewing machine. Privilege can be waived.

RHODE ISLAND. — Debtor must be a householder to entitle to exemption of $300 herein specified.

SOUTH CAROLINA. — All necessary wearing apparel. Homestead right cannot be waived.

TENNESSEE. — (See table.)

TEXAS. — In a city, a lot or lots not exceeding $5,000 in value, if same be used as a home, or place to carry on business; of head of a family, five milch cows and calves, two horses and wagon, two yoke of oxen, twenty hogs, twenty sheep, all tools and articles of husbandry, and all necessary provisions for home consumption.

UTAH. — $250 extra for each member of the family; also, farm stock, tools, provisions, household furniture, and wearing apparel.

VERMONT. — Two horses, one cow, ten sheep, one yoke of oxen, household furniture, tools and wearing apparel.

WASHINGTON TERRITORY. — Very near same as California.

WEST VIRGINIA. — Debtor must be a husband or parent and resident to avail himself of homestead exemption, and must be both resident and parent to avail himself of personal property exemption.

WISCONSIN. — Also span of horses or mules, yoke of oxen, ten sheep, ten swine, two cows, printing materials or presses up to $1,500. Heads of families can retain sixty days' earnings.

WYOMING. — Same as California.

INTEREST AND USURY LAWS OF THE UNITED STATES.

STATES AND TERRITORIES.		Legal rate.	Excess forfeits interest.	Excess forfeits interest and principal.	Conditional rates.
Alabama......		8	*		
					On overdue accounts.
Arizona........	*t. u.*	10			10
Arkansas......		6		*	10
					On overdue accounts.
California.....	*t.*	7			10
Colorado......	*u.*	10			
Connecticut...	*j.*	6			
Dakota.......		7		*	12
Delaware.....	*s.*	6		*	
Dist of Columbia,		6	*		10
Florida.......	*u.*	8			
Georgia.......		8			12
Idaho	*r.*	10			24
Illinois........		6	*		8
Indiana.......	*c. k.*	6			8
Iowa.........	*i.*	6	*		10
Kansas.......	*c.*	7	*		12
Kentucky.....	*h.*	6	*		6
Louisiana.....	*d. v.*	5	*		8
Maine........		6			
Maryland.....	*k.*	6	*		
Massachusetts,	*t.*	6			
Michigan.....	*t. k.*	7			10

STATES AND TERRITORIES.		Legal rate.	Excess forfeits interest.	Excess forfeits interest and principal.	Conditional rates.
Minnesota....	*w.*	7		*	12
Mississippi	*t. n.*	6			10
Missouri	*i.*	6			10
Montana......	*u.*	10			
Nebraska.....	*t.*	7	*		10
Nevada	*j t.*	10			
New Hampshire,	*x. m.*	6			
New Jersey...	*x.*	6			
New Mexico..	*l.*	6			12
New York....	*r. v.*	6			
No. Carolina..	*a. h. t*	6	*		8
Ohio.........	*l. t.*	6			8
Oregon.......	*t. q.*	10		*	12
Pennsylvania..	*h. f. k.*	6			
Rhode Island.	*j.*	6			
So. Carolina...		7	*		
Tennessee	*c.*	6			6
Texas........	*t. k.*	8	*		12
Utah.........	*u.*	10			
Vermont	*h. n.*	6			
Virginia	*h.*	6	*		
Wash. Territory,	*u.*	10			
West Virginia,	*y.*	6			
Wisconsin	*h*	7	*		10
Wyoming.....	*u.*	10			

a. — Interest, if not paid, becomes a new debt.

b. — Interest on open accounts dates from next January 1.

c. — Excess of interest paid is held to be on account of principal.

d. — Higher rate permitted if embodied in the note; *i. e.*, in the principal.

e. — Instruments showing usury on their face cannot be sued on.

f. — May take higher rates from parties out of State.

g. — Principal forfeited to county school fund.

h. — Excess may be recovered back.

i. — Creditor takes only principal, while the interest, at 10%, goes to State.

j. — Any rate by contract.

k. — Usurious cannot be collected.

l. — No penalty.

m. — Above legal rate forfeits three times the excess.

n. — Forfeit of interest in excess of legal rate.

o. — " of principal and interest.

p. — " of interest and costs.

q — " of three times the amount of interest accrued.

r. — Punishable as a misdemeanor.

s. — One half to State, one half to prosecutor.

t. — Above legal rate, must be in writing.

u. — No limit.

v. — Excess may be recovered.

w. — Since July 1, 1879, 7% on everything.

x. — Principal and interest may be recovered.

y. — Interest may be recovered.

LIMITATION OF SUITS.

STATES AND TERRITORIES.	Slander, Replevin, etc.	Ordinary Accounts.	Written Agreements.	Judgments.	Witnessed Agreements, etc., under Seal.	LIMITATIONS OF SUITS.
	Years.	Years.	Years.	Years.	Years.	
Alabama	1	3	6	20	10	*n, h.*
Arkansas	1	3	5	10	10	*n, g, h.*
Arizona						
California	3	2	4	5	5	*d.*
Colorado	1	6	6	6	6	*u.*
Connecticut	3	6	6	6	17	*n, o, q, y, z,* †.
Dakota	2	6	6	20	20	
Delaware	1	3	6	20	20	*j, n.*
District of Columbia	1	3	3	12	12	
Florida	2	3	5	20	20	*k.*
Georgia	1	4	6	7	20	*m.*
Idaho	3	2	4	5	5	
Illinois	1	5	10	20	10	*h, e.*
Indiana	2	6	20	20	20	*h*
Iowa	2	5	10	20	10	
Kansas	1	3	5	5	15	*h, n.*
Kentucky	1	5	15	15	15	*j, v.* *.
Louisiana	1	3	5	10	20	*i. v.*
Maine	2	6	20	20	20	*h.*
Maryland	3	3	3	12	12	*i, m.*
Massachusetts	2	6	6	20	20	*h, n, o.*
Michigan	2	6	6	10	10	*n, o.*
Minnesota	2	6	6	10	20	*h.*
Mississippi	1	3	6	7	7	*w, f, x.*
Missouri	1	5	10	20	10	*h.*
Montana	2	2	4	5	4	
Nebraska	2	4	5	20	10	*h,* §.
Nevada	2, 6	4	6	6	6	*h.*
New Hampshire	1	6	6	20	20	*f.*
New Jersey	2	6	6	20	16	*n.*
New Mexico	1	3	10	10	10	
New York	1	6	6	20	20	*h.*
North Carolina	1	3	3	10	10	*n, h.*
Ohio	1	6	15	15	15	*n.*
Ontario	1	5	5	30	30	
Oregon	2	1	6	10	10	*h.*
Pennsylvania	1	6	6	20	20	*f.*
Quebec	1, 2	5	5	30	30	
Rhode Island	1	6	6	20	20	*r.*
South Carolina	2	6	6	20	20	*l.*
Tennessee	1	6	6	10	10	*k.*
Texas	1	2	4	10	10	*a.*
Utah	1	2	4	5	7	
Vermont	2	6	6	8	14	*h, s.*
Virginia	5	5	5		20	*k,* *
Washington Territory	2	3	6	[illegible]	20	
West Virginia	5	5	5	10	10	*c, t, h,* ¶.
Wisconsin	2	6	6	20	20	*b, n.*
Wyoming	1	6	15	10	21	

a. Mortgage lien barred with mortgage note, but new promise revives.

b. Where cause of action accrues within State.

c. Contracts prior to 1869, April 1.

d. Foreign notes and obligations barred in two years.

e. Foreign judgments barred in ten years.

f. Revivor : Promise to pay or acknowledgment; promise will be implied.

g. Don't apply to non-residents.

h. Revivor : Part payment or promise in writing.

i. Revivor : Verbal promise will revive a claim barred by statute.

j. Revivor : Direct acknowledgment or admission of debt.

- *k.* Revivor: Part payment not sufficient, must be promise in writing.
- *l.* Revivor: No revivor statute, common law.
- *m.* Revivor: Foreign judgments barred since Jan. 1, 1870, if obtained before June 1, 1865.
- *n.* Persons under legal disabilities have longer time.
- *o.* Absence from State suspends action.
- *q.* Applies to non-residents also.
- *r.* Twenty years' uninterrupted possession of real estate gives evidence of title.
- *s.* Sealed instruments not witnessed barred in eight years.
- *t.* Under seal twenty years.
- *u.* Since May 15, 1879.
- *v.* No disability can extend time longer than thirty years.
- *w.* Foreign judgments barred in three years.
- *x.* Real actions ten years.
- *y.* Account not in writing three years.
- *z.* Writing under seal, non-negotiable paper, seventeen years.
- †. To recover real estate fifteen years.
- *. Store account two years.
- ¶. Store account three years.
- §. Foreign judgments five years.

DIVORCE.

A DIVORCE is the total or partial suspension of the marriage relations by an act of law, and the legal causes for the same are, generally speaking, adultery, cruelty, desertion, imprisonment for felony, and confirmed habits of intoxication; and the defences usually resorted to are connivance, collusion, condemnation, and recrimination. The decrees of divorce are of three kinds,—viz., *nisi*, *à mensa et thoro*, or *à vinculo;* and an explanation of the terms will be found in our chapter on definitions. In some cases, perhaps, a divorce *à vinculo* may be necessary; but there is no person of ordinary intelligence who will deny that the vast majority of the divorces granted in our day are unnecessary. Divorce is the upas-tree of our social system, and its baneful effects upon the morals can hardly be estimated or understood by our people; for, if it were, the present laxity of the laws on this subject would continue only for a very short time. A divorce may well be compared to a leper, for all should shun it and no one can touch it without being contaminated. If, after you have fully considered what the effect will be on your own good name and upon your children and family at large, you are determined on seeking a divorce, have at least sense enough to avoid divorce brokers, who advertise so freely, and go to some respectable lawyer and act on his advice.

Having swept with our mind's eye the horizon of the law, perhaps it may be well for us to meditate on the advantages of the law; although some writers allege that the law has no advantages, but takes all it can get from those silly enough to enter its labyrinths. The law may be compared to an old-fashioned well,—very easy to get into, but deuced hard to climb out of. And so it is with a lawsuit: it is very easy to start one, but you can never tell where you are going to fetch up, and no man can tell the cost. Judge Russell, of the Massachusetts bar, says, "Don't try your case on the street corners or over the fences, but take them to a court of justice and keep your mind to yourself." And we have no doubt that every lawyer in the land will heartily indorse this piece of advice; for nothing is so annoying to a lawyer as to find that his client has been talking about his case to every one, and has thus enabled his opponent to be armed at the very point where weakness was to be expected. But to you, kind reader, I will say, with a deep appreciation of the import of my words, avoid litigation as you would a person whose manners were repugnant to you. But if, after patient effort to avoid a lawsuit, you find yourself sorely pressed to begin one, or allow it begun against you, remember that "it is wise to begin nothing of which you have not well considered the end."

> "I'll hold, because I judge thee wise,
> And few words unto such suffice."

LAWS OF THE DOMINION OF CANADA.

The laws of Canada relating to copyright, patents, naturalization, power of attorney, insurance, hotel and inn-keepers' liabilities, bills and notes, insolvent debtors and mechanics' liens, are treated of under their respective heads.

PROVINCE OF QUEBEC.

[The civil laws of this Province are founded on the French "customary" or common law. A code exists, the laws having been first codified in 1866. As it now exists, the code is in many respects similar to the *Code Napoleon*, but contains many of the distinctive features of the English and United States statute law. The criminal code in this and all the Provinces is founded on English law, and is identical throughout the Dominion.]

Aliens.—Aliens have a right to acquire and transmit by gratuitous or onerous title, as well as by succession or by will, all property in Lower Canada. They may be sued in the courts for the fulfilment of obligations contracted by them even in foreign countries.

Attachments.—The plaintiff may attach, in case of movables, fifteen days after judgment or sooner, and even before judgment, by making affidavit that the debt is above five dollars, that the debtor has absconded, or is about to do so, or is secreting his property; or that defendant is a general trader, is notoriously insolvent, and has refused to make any arrangement with his creditors. The affidavit must aver also that the affiant believes that without the attachment the debt will be lost.

Chattel Mortgages.—There is no such thing as a chattel mortgage, except in case of vessels in the course of construction, to which a special act applies. Money can be raised on movables only by actually placing them in the hands of the lender.

Deeds.—When parties residing in the United States execute deeds to property in the Province, the laws of the place where the deed is made are followed. The witnesses, or one of them, must make affidavit as to the signatures before the mayor or chief magistrate of the place, who must give a certificate to that effect which should be attested by the nearest British consul. Such and all other deeds must be registered in the county where the land lies, in conformity with the requirements of the code. If the authenticity of a deed made out of the Province is questioned, it must be established where made before a commissioner appointed by the court.

Exemptions.—The following articles of personal property are exempt from execution: bed and bedding, wearing apparel, furniture, cooking utensils, hunting and agricultural implements, minutely specified in the statute; fuel and food for thirty days, not above $20 in value; one cow, two hogs, four sheep, fifteen hives of bees; tools of a trade not over $30 in value; ten books. But when the suit and execution is for the price, there is no exemption. Also are exempt, sums of money given as *aliment*, or when the donor specifies in the gift that the money shall be exempt, and wages and salary not yet due.

Interest.—Any rate may be agreed upon. The legal rate is six per cent. Six per cent. is charged on judgments.

Married Women.—Three estates of property exist after marriage. The husband and wife each retains control of all the immovable property belonging to him and her at the time of marriage. The third, or *community* estate, over which the husband has full control, consists of all movables owned by either at time of marriage, and all property of any kind acquired by either afterwards. The wife's separate estate is also administered by the husband, and she cannot part with it without his consent. The wife may will separate property as she chooses; the husband cannot bequeath more than his half interest in the common property. If a married woman becomes a public trader she binds her husband, unless she is separated and has her deed of separation recorded. Full divorce cannot be obtained without a special act of the Dominion Legislature, sanctioned by the Crown.

Mortgages.—HYPOTHECS or mortgages

are classed as legal, judicial, or conventional; the first resulting from the law, the second from judgments of courts, and the third from agreements. Mortgages cannot be acquired upon the immovables of persons notoriously insolvent to the prejudice of their creditors.

Wills.— All persons above twenty-one and of sound intellect can will property. There are three kinds of wills: 1. The *authentic*, or French will, executed before two notaries, or one notary and two witnesses, not females. 2. The English will, for which at least two attesting witnesses, male or female, are necessary. 3. The olograph will, written throughout in testator's handwriting and signed by him, for which no witnesses are required. The English and the olograph wills must be probated.

PROVINCE OF ONTARIO.

Aliens.— The disabilities formerly imposed on aliens have been removed. Aliens can buy, sell, and hold real and personal property in the same way as citizens. A non-resident who brings an action in the Province is bound, if asked, to give security for costs.

Attachments.— A judge's order may be obtained for attachment of property, upon the affidavit of the creditor that the debtor has absconded to defraud the plaintiff or to avoid arrest and service. Other creditors may come in by issuing attachments within six months of the date of the first writ.

Chattel Mortgages. — All sales and pledges of personal property are void as against creditors and subsequent purchasers or mortgagees in good faith, unless there is immediate delivery, or unless the chattel mortgage is registered with the clerk of the county court where the mortgagor or seller lives within five days, together with affidavit as to execution by a subscribing witness, and the affidavit of the buyer or mortgagee as to good faith. To keep up the debt, a statement must be filed within thirty days of the expiration of the year, showing the amount due and payments made, with affidavit of the mortgagee as to truth and good faith.

Deeds.— A seal must be used; a scroll will not suffice. Two witnesses attest the signatures. The deed is proved by affidavit of a subscribing witness, on a memorial left for permanent record with the registrar of the county where the property lies. The word "heirs" must be used to make an estate in fee. Affidavit to prove deeds or mortgages may be taken within the Province before a commissioner, the registrar of deeds, or the judge of a court of record; in Great Britian, before the judge of a superior or county court, the mayor or chief magistrate of a town, borough, or city, under the common seal of such town, city or borough, or a commissioner of deeds; in foreign countries, before the mayor of any city, town, or borough corporate, certified under the common seal, before any British consul or vice-consul there resident, or before a notary public or court of record.

Exemptions. — Free grants and homesteads to actual settlers in the districts of Algoma and Nipissing, and of certain lands between the Ottawa River and the Georgian Bay, are exempt from execution. Personal property; beds, bedding, furniture (a few articles), tools of a trade to the value of $60, fifteen hives of bees, provisions to the value of $40, one cow, four sheep, two hogs, and fodder for thirty days are exempt.

Interest.— Legal rate six per cent. Contract may be made for any rate. Banks cannot recover more than seven per cent.

Married Women.— If the marriage took place since May 4, 1859, the wife holds all her property, real or personal, free from the control or debts of the husband, except that given to her by him after marriage. If the marriage was prior to that date, the wife has control of all real estate not already reduced to possession by the husband. The separate property of the wife is liable for her debts before marriage. The wife may carry on a business, trade, or profession as though she were a single woman, and her wages and earnings are free from the husband's control. She may sue and be sued, hold stocks, make deposits, and execute deeds and wills in all respects as though she were a single woman. She may insure her husband's life for her own benefit, and the insurance will be free from his creditors. The right of dower still exists. A husband becomes tenant by courtesy of all lands of which his wife died seized.

Mortgages.— The execution is in all respects like that of other DEEDS (*which see*). The certificate of registration is also drawn in the same manner. A mortgage is foreclosed by suit in equity before the high court. A special Dominion act regulates the recovery of interest on mortgage debts. There is no equity of redemption after the decree and sale.

Wills.— All persons over twenty-one, and of sound mind, can make a will. Two attesting witnesses are necessary. No special form of attestation is required. A devise or legacy to a witness, or the husband or wife of a witness, is void. An executor is competent as a witness.

NEW BRUNSWICK.

Attachments. — By an act of the General Assembly of 1880, all previous laws in regard to attachment were repealed.

Chattel Mortgages. — Mortgages on personal property are recognized. They must be recorded with the registrar of the county where the vendor, or mortgagor, lives; the registry need not be renewed from year to year. Bills of sale must be recorded.

Deeds.— Deeds must be in writing, signed and sealed. A wafer or adhesive paper may be used for a seal; a scroll will not suffice. At least one witness must attest the signature. A deed is acknowledged in or out of the Province in the same manner as in ONTARIO (*which see*). When a married woman joins her husband in conveying, she must be examined apart from him, and the magistrate must certify that she acknowledged that she joined in conveying of her own free will.

Exemptions. — The Homestead Act gives the owner of a homestead exemption to the value of $600. Personal property; household effects to the value of $60; wearing apparel, bedding, kitchen utensils, and tools of a trade or calling, to the value of $100, are exempt.

Interest.—Any rate may be agreed upon. If none is contracted for, and upon all judgments, the legal rate is six per cent.

Jurisdiction.— Magistrates have jurisdiction when the amount involved is not greater than $20; if from $20 to $200, the county court has jurisdiction; supreme court from $200 upward.

Married Women.— The real or personal property belonging to a woman before or accruing after her marriage, excepting only gifts from the husband after marriage, is her separate property, and free from her husband's control or debts. The wife's separate property is liable for her ante-nuptial debts. In case of separation or abandonment or desertion by the husband, the wife may carry on business, sue and be sued, and control her property as if a single woman. A widow is entitled to dower.

Mortgages —A mortgage must be executed in all respects like a deed. A scroll will not answer for a seal. The execution is proved by a memorial, and if out of the Province, before a proper officer. See the rules laid down for deeds in Ontario. Foreclosure is by bill in equity. There is no equity of redemption after decree and sale. "Tacking" is not allowed. When the mortgagee has entered into possession, suit to redeem must be brought within twenty years.

Wills.— Any person of age and of sound mind may make a will. Married women, however, must obtain the consent of the husband, endorsed upon the will. Two or more witnesses are required. No special form of attestation is prescribed. A devisee or legatee is a competent witness; but the will is void so far as regards the legacy or devise to him.

NOVA SCOTIA.

Aliens.— By act of the Dominion Parliament the disabilities formerly existing have been removed; aliens may buy, sell, and hold real or personal property in the same manner as citizens.

Attachments. — When the suit is for twenty dollars or more and the debtor has absconded, an order of attachment will issue upon an affidavit of the facts by the creditor. Subsequent attachments are allowed by other creditors.

Chattel Mortgages.— While the law does not recognize mortgages of personal property, though bills of sale with a defeasance attached or recorded therewith, are considered as such, to make the pledge there must be actual transfer of possession. Bills of sale must be recorded with the registrar of deeds of the county where the maker resides.

Deeds.— A deed must be in writing, signed and sealed (a scroll will not suffice), and attested by at least two witnesses. The rules as to registry and proof by means of memorial or attached certificate are about the same as in Ontario. By an act of 1879, all deeds executed out of the Province are admitted in evidence upon such proof of their due execution as is required to entitle such deeds to registry in the Province.

Exemption.— By an act of 1877 the law in regard to Free Grants and Homesteads was repealed; but no rights acquired by any party located on land under the provisions of that act are affected. Personal property; necessary wearing apparel and bedding, tools of a trade, a stove, and one cow, are exempt from execution, except in cases of Distress for Rent, then all these exceptions do not apply.

Interest. — Legal rate, six per cent. Contract may be made in writing for any rate not above seven per cent., when the security is real estate or chattels real, or for ten per cent. where the security is personal property or personal responsibility. Excess of interest forfeits the excess only.

Jurisdiction. — Magistrates have jurisdiction up to $20; county courts from $20 to $200; supreme court from $200 upward.

Married Women. — The husband's property is liable for debts contracted by the wife before marriage. The husband has full control over wife's property acquired after marriage, if by him reduced to possession. In general, the common law principles prevail. When the wife has been deserted, or a separation has taken place, an order of protection will be issued, and she may then manage her estate as though she were a single woman.

Mortgages are all common law mortgages with no power of sale. The execution, attestation, and proof of mortgages is, in every respect, like those of other deeds. Foreclosure is by petition and decree in a court of equity. A mortgage is deemed to be satisfied in twenty years if there has been no payment of interest or written acknowledgment.

Wills. — No person under twenty-one years of age can make a will. Married women must have the written consent of the husband before making a will. At least two witnesses must attest the will. No special form of attestation is required. Nuncupative wills may be made by sailors or soldiers in actual service. Marriage revokes a will, except made in exercise of a power of appointment. Executors, devisees, and legatees are competent witnesses, but a legacy or devise to an attesting witness will be void.

MANITOBA.

The laws of this Province are similar in nearly all respects to the laws of Ontario, except those relating to the half-breed residents.

NEWFOUNDLAND.

The laws of Newfoundland are, in the main, similar to the common law of England.

DIGEST of PARLIAMENTARY LAW

EVERY body assembled for the purpose of deliberation finds it necessary, both for its proper organization and to facilitate its proceedings, either to adopt special rules for the regulation of such proceedings, or to act upon those which are generally accepted as the ordinary rules of parliamentary practice. The special rules which any assembly may form for its guidance and government supersede, in all points to which they relate, the common parliamentary law, leaving the latter in full force in all other respects.

The following is a synopsis of the generally accepted laws of parliamentary practice in this country: —

ADJOURNMENT.

1. A motion to adjourn is always in order.
2. Is not debatable.
3. Cannot be amended, except there is no other business before the meeting.
4. Some proceeding must intervene before a second motion to adjourn can be entertained.
5. It stops, when carried, the further consideration, at that time, of any question which was pending when it was made.
6. The main question can be referred to in discussion, if the *motion to adjourn involves its merits.*
7. Reconsideration not allowed.
8. Cannot be entertained while any one has the floor.
9. Adjournment to a particular time may be amended or reconsidered.

AMENDMENTS.

1. To be entertained, must be germane to the original motion, though they may be directly opposed to its intent.
2. Are debatable.
3. May be amended *once.*
4. May be reconsidered.
5. Are *put* before the main question.

AMENDMENT TO AMENDMENT.

1. Is debatable.
2. Cannot be further amended.
3. May be reconsidered.
4. Must be voted on before the first amendment or original motion.
5. Amendments may be superseded by a motion to postpone or to commit.

AMENDMENTS are generally introduced when the assembly is satisfied with the subject-matter of the original motion, but dissatisfied with some of its parts, or with the form in which it is presented. But amendments are admissible which entirely alter the nature of the original proposition, from the fact that a motion, when once stated by the chair, is the property of the house, and it is the privilege of the assembly to alter it to any extent it may see fit.

They are sometimes adopted as a means of defeating the original motion by extending its principle, and thus show its absurdity so clearly that the house will not agree to it.

Sometimes the mover of the original proposition accepts the proposed amendment, and, if no one objects, the amendment is embraced in the original proposition: but if there is objection, a motion is necessary to obtain the consent of the assembly; otherwise it must be put separately as an amendment. The mover, however, has a right to move an amendment to his own motion.

The manner in which propositions are generally amended is either by striking out certain words, adding words, or by both striking out and inserting.

Amendments may be amended once, but no more. Thus, if a motion be made that A, B, C, D represent a certain thing, and an amendment be made to strike out D, which is further amended by a motion to strike out C, another amendment to strike out B would not be in order. The question is taken first on the amendments. If the amendments be carried in the affirmative, the question is then on the original proposition as amended. If the decision on the amendment be negative, the question recurs on the main proposition. If the decision on the second amendment be affirmative, the first amendment must be put as amended, and so with the main question.

In putting a motion for striking out words, the parliamentary form is, "Shall the words stand as part of the main question?"

In case of the rejection of an amendment to insert certain words, a motion to insert the same words, or any part thereof, is not in order; but a motion to insert the same words with others is. Or, when a motion is carried to insert certain words, it will not be in order to move to strike out the same words, or a part of them, but a motion to strike out the same words with others is permissible.

When a motion is made both to strike out certain words and to substitute others, any member may call for a division of the question. When a division is ordered, action is first taken on the motion to strike out, which is put in the usual form, viz., "*Shall the original motion stand?*" And if the decision be in the negative, the question is put on the insertion, which may also be amended. When a negative decision is given on a motion to strike out and insert without the question being divided, it is not in order to have the same motion made again. If an affirmative decision be given on a motion to strike out and insert, it would not be in order to move to strike out the words inserted, or insert the words struck out.

COMMITMENT.

1. Motion to commit may be debated.
2. Can be amended.
3. May be reconsidered.
4. Is not superseded by the previous question or postponement.
5. Has precedence of a motion to amend.

COMMITTEES.

Committees are usually of three kinds, — *special*, *standing*, and *of the whole*. A special committee is one selected for a particular purpose. A standing committee is one to which is referred all matters of a like nature, as the committee of ways and means; it is a permanent body. A committee of the whole is composed of all the members of the house.

The object of committees is to facilitate business by dividing it among the members, which can thus be more readily accomplished than by the entire body giving their attention to the details of each particular subject.

Committees are sometimes given full powers and sometimes their authority is restricted, both depending on the instructions given by the assembly. They are appointed by the chair or the house, and occasionally by ballot. When nominated by the house, the names are voted on singly; and when by ballot, they are chosen either singly or all together.

The mover and seconder of a motion to constitute a committee are generally by courtesy appointed to serve on it; and the person first named usually acts as its chairman, though every committee has a right to elect its own chairman, who makes the report to the meeting. A majority of the members of a committee is necessary for a quorum.

The committee may meet when and where it pleases, and adjourn from time to time as it sees fit, unless otherwise ordered by the assembly. In committee meetings the same parliamentary forms obtain as in the regular assembly, except in committee of the whole.

The chairman of the committee, in making the report, reads it to the meeting, and delivers it, and all papers connected therewith, to the clerk or secretary. When the report has been read and accepted the committee is discharged, except the report be recommitted.

It is customary to put the question on the acceptance of the report, without the formality of a motion. The acceptance of a report is not to be confounded with its adoption, the latter being a matter afterwards to be considered by the assembly.

COMMITTEE OF THE WHOLE.

When it is resolved to go into committee of the whole, the chairman of the assembly, as a rule, calls upon some member to act as chairman of the committee, and the secretary or clerk is appointed by the committee. The president of the assembly is supposed to remain in the committee till it rises or breaks up for want of a quorum, so as to be able to take the chair when the assembly is again called to order.

The committee of the whole does not adjourn, — it merely rises; and a motion that the committee "do now rise" is made when the labors of the committee are ended. If not completed at one session, the motion is, "That the committee do now rise and ask leave to sit again."

The previous question is not allowed in committee of the whole, but members can speak as often as the chair will recognize them; and no business can be referred to a subordinate committee; neither can a member be punished or expelled for a breach of order, but must be reported to the assembly.

The chairman of the committee makes the report to the meeting, which is received and acted on in the same manner as the report of any other committee.

TO COMMIT.

A matter may be referred to a committee with or without instructions. Instructions, if given, must be followed; if none be given, the committee have full powers. This motion can be amended, and, if first made, is not superseded by the previous question or postponement. *Recommit* is the term applied when the matter has been once in the hands of a committee.

CHAIRMAN'S DECISION.

To appeal from. — 1. Is debatable, cannot be amended, but may be reconsidered.
2. Is always in order, even when another has the floor.

DEBATE.

To close. — Is not debatable, but may be amended or reconsidered.

To limit. — Is not debatable, but may be amended or reconsidered.

Order of. — The presiding officer cannot participate in debate. Should he wish to do so, he must ask the vice-president or some other member to take the chair. From the chair he can only state general matters of fact within his knowledge, and decide points of order.

The mover, as a rule, if he rises to speak, is given the preference; and if two or more claim the floor, it is customary to give the preference to one opposed to the motion. A member, in resigning the floor to accommodate another, even for a moment, is not entitled to it again, though it is customary to concede it to him.

Members, in speaking, are not to refer to others by name, but to designate them as "the previous speaker," "the gentleman on my right, or left," or in some such way as would indicate the party referred to.

Decorum in. — Common decency, as well as the general rules of order, requires that a member should be accorded a courteous attention while speaking, and that all hissing and unnecessary calling for the question, and ironical cries of "Hear, hear," are decidedly out of order. A person with any discernment can readily tell whether the assembly be inclined to listen to him; and if he find they be not, prudence would suggest that he resume his seat as soon as he consistently can, without making too sudden a collapse.

Should any member or members persist in disturbing the meeting after being called to order, he may be called on by name by the chair to withdraw, and the assembly decides what action shall be taken. As a rule, the efforts of the chair to preserve order are supported by the assembly; if not, the self-respecting chairman will vacate his position.

DIVISION OF A QUESTION.

When a motion is composed of two or more parts, which are capable of being considered separately, it is usual to amend the original motion by calling for a division of the question, or by motion, regularly seconded, that the question be divided.

A party moving to divide a question should state how he desires the division made.

LIE ON THE TABLE.

1. Is not debatable.
2. Cannot be amended.
3. Supersedes all the other subsidiary motions.
4. Cannot be reconsidered when the vote is affirmative.

This motion supersedes all other subsidiary ones. It is used either to finally dispose of a matter, or to lay it aside for an indefinite time. An affirmative decision removes all other motions from before the house; a negative allows the business to proceed as before the motion was made. To renew debate on the subject tabled, a motion to "take from the table," properly made and carried, opens the same question.

To take from the table. — 1. Is not debatable, nor can it be amended.
2. A vote in the negative may be reconsidered.

MOTIONS.

1. Must, as a general rule, be seconded. The Massachusetts Legislature does not *now* require a motion to be seconded.
2. Must be stated by the chair before they are open for discussion or amendment.
3. Principal and subsidiary motions cannot be made together.
4. Can only be withdrawn by consent of the house, after being stated.
5. Original motions may be superseded by motion "to table," a question of privilege, a question of order, to commit, or to amend.
6. Are not in order unless the maker is recognized by the chair.

Motions are propositions introduced by members. They are either *principal* or *subsidiary.*

Subsidiary motions relate to the original or principal motion, and are used to facilitate the disposal of the latter. The most common are,—to lie on the table, for the previous question, to postpone, to commit, and to amend. (See notice of them under their respective heads.)

A motion, after being properly made and seconded, is then stated by the chair, and discussion is in order, and no other motion can be received except a subsidiary one.

If there be several subsidiary motions in addition to the principal question before the house at the same time, the subsidiary motions are first settled in the order of their precedence,—viz., to lie on the table; on the question to commit; on the question to amend; and, finally, on the main question.

Principal and subsidiary motions cannot be made at the same time.

DUTIES OF OFFICERS.

President.—The following are the principal duties of the president: To call the members to order at the time appointed; to announce the business in its regular order; to receive and put to vote all motions properly presented, and declare the result; to keep order; to receive and announce all communications; to sign all necessary documents; to rule on points of order; to appoint members of committees (when so directed); to represent the will of the assembly, and look after its interests.

Vice-President.—If there be one or more vice-presidents, it is the duty of one of them to preside in the absence of the president; and if there be none, a temporary chairman is elected, in the choice of whom the secretary carries on the proceedings.

Secretary.—The secretary's duties are, to make a record of all things done in the assembly; to call the roll; to read all papers; to notify all committees appointed, and of the business referred to them; to sign such papers as may be necessary; to take charge and care of all the papers belonging to the assembly.

ORDERS OF THE DAY.

Orders of the day are the questions specially assigned for a particular day, and a motion calling for them has precedence of all others. A negative decision keeps the question, which was pending when the call was made, still before the house, while an affirmative decision removes it.

1. Are put in preference to all subsidiary and incidental motions.
2. The motion calling for them is not debatable, nor can it be amended, but it may be reconsidered.
3. This motion must be entertained, even though another has the floor.

ORDER OF BUSINESS.

All organizations have an established order of business, and sometimes make special orders in relation to particular subjects. When a motion is made to consider a proposition made up of several paragraphs, it is read paragraph by paragraph; and amendments, if any, offered on each paragraph when read. When all have been thus gone through, the question is taken on the paper as a whole, whether amended or not.

On a paper being reported back from a committee to which it had been referred, the amendments *only* are read in their order until all are adopted or rejected, before any other amendment is in order, except an amendment to an amendment. When the committee's amendments have been acted on, and amendments, if any, proposed by the house passed on, the final question is on the adoption of the paper as a whole.

Introduction of Business.—When a member wishes to make or second a motion, or make any statement to the meeting, he must address the chair, and by him be recognized by name; he is then said to *have the floor*, and may proceed. If two or more members rise to address the chair at the same time, the chair recognizes him whose voice he first heard; and if his decision be questioned, the sense of the house is taken.

A petition, if from outside parties, is usually presented by some member, who states the substance of it and moves it be received. Usually, if there be no objection, it is received without the formality of a motion. After being read by the clerk or secretary, it is then the property of the meeting, to be disposed of as they see fit.

QUESTIONS OF ORDER.

Questions of order are those which relate to some breach of the rules. When a point of order is raised, it is decided by the chair without discussion, which decision may be appealed from and passed on by the house. The chair, in stating the question on the appeal, says, "Shall the decision of the chair stand?" And in the debate, if any, which follows, the chair can participate.

If a member has the floor he cannot be interrupted except by a call to order, and, after the point of order is decided, he may be allowed to continue. A member, when rising to interrupt another, must state whether it is on a point of order, a question of privilege, or for the orders of the day; and it is usual for the chair to recognize such persons and ask them to "state the point," etc. In the mean time the person interrupted takes his seat and remains there till the question is settled, when he can resume.

It is considered in bad taste to be too punctilious in making points of order, and some members, in many organizations, often do so, more from a desire to display their knowledge of parliamentary law than to facilitate business; and the frequent "*rising to a point of order*" by the same member generally causes him to be viewed as a parliamentary "crank."

In most organizations, and even in our legislative assemblies, strict adherence to parliamentary forms is not followed in all its minor points; the essential aim and object of such forms being to arrive at conclusions and to register the will of the majority in as common-sense and equitable a manner as possible. And in this connection we would advise those who are ambitious to shine as parliamentarians, and who fancy they are destined

> "The applause of listening senates to command,"

to keep their knowledge of the subtleties of the laws of debate from effervescing, and permit the business to proceed if no *material right* is being infringed.

READING OF PAPERS.

1. When bearing on a question before the house, any member has a right to call for a reading.
2. When relating to original matter, must be voted on.
3. Is not debatable, and cannot be amended, but may be reconsidered.

PREVIOUS QUESTION.

1. Cannot be debated or amended.
2. Takes precedence of all subsidiary motions, when made first, except to lie on the table.

The moving of the previous question, in this country, is generally for the suppression of discussion of the main question. It cannot be moved in committee of the whole. After being moved and seconded, the chairman asks, "Shall the main question be now put?" And if decided affirmatively, the main question is put immediately and without debate. If the decision be negative, it operates differently in different assemblies. In our national Congress it disposes of the main question for the day, while in the legislatures of Massachusetts and New York it leaves the original question still open for discussion.

POSTPONEMENT.

1. Is debatable.
2. May be amended or reconsidered.
3. Cannot be superseded by motions for the previous question, to commit, or to amend.
4. Whether postponement be for a definite or indefinite time, the three preceding rules apply.

Definite Postponement. — A motion to postpone to a certain day, if decided affirmatively, removes the main question from before the house; but if the decision be negative, the suppression of the original motion may then be brought about by the previous question.

Indefinite Postponement. — An affirmative decision on this motion entirely suppresses the original proposition, so that it cannot be renewed; a negative decision leaves the question before the house.

PRIVILEGED QUESTIONS.

1. Cannot be debated or amended, but may be reconsidered.
2. Take precedence over all others.

Privileged questions are those of greater importance to the assembly than the one under discussion. They have precedence of all other questions, and consist of *motions to adjourn*, questions *relative to the rights of members*, and *those calling for the orders of the day.*

PRECEDENCE OF QUESTIONS.

1. To adjourn.
2. To lie on the table.
3. For the previous question.
4. To postpone to a certain time.
5. To commit.
6. To amend.
7. To postpone indefinitely.

Incidental questions embrace questions of order, motions for leave to withdraw a motion or to suspend a rule, or to ask for the reading of papers, or an amendment of an amendment. They have precedence of the questions *from which they arise.*

Taking the Question.—After all, who seem desirous, have spoken on a question the chair asks the assembly if they *are ready for the question*, and if no one responds, or "Question?" is cried by one or more members, the chair says, "All who are in favor of the motion answer *aye*." He then says, "As many as are opposed say *no*." And, according as the *ayes* or *noes* predominate, he says, *The ayes have it*, or *The noes* have it, or *It is*, or *It is not a vote.* If he has a doubt as to which side has a majority, or if, having decided, a member doubts the result as announced, the chair may call on the members to rise and stand till counted on both sides; or he may divide the house, ranging affirmatives on one side and negatives on the other. Should a vote result in a *tie*, the chair has the casting vote, and while solving a doubt no other business is in order.

Yeas and Nays.—On taking what is called the *yeas* and *nays*, it is stated by the chair thus: "As many as are in favor of, etc., will, when their names are called, answer *aye*, and those opposed will answer *no*." The clerk or secretary calls the roll and marks the answers, and reports to the chair, who announces the result to the meeting.

Until the negative of a question is put, it is in order for a member to speak, or make any subsidiary motion; but when taking the *yeas* and *nays*, both being taken at the same time, neither debate nor a motion is in order.

RECONSIDERATION.

A vote already passed may be reconsidered, except a motion to adjourn; and if the motion to reconsider be carried, the original motion is before the house.

1. Can be debated together with the original motion, but cannot be amended or reconsidered.
2. If carried in the affirmative, it opens the main question for discussion.

RECOMMIT.

Can be debated, amended, or reconsidered.

SUSPENSION OF RULES.

1. Is not debatable, nor can it be amended or reconsidered.

A suspension of a rule may be called for by a motion regularly made and seconded, and has precedence of the original motion. It is usually made for the purpose of allowing some business to proceed which some rule of the assembly prohibits.

QUORUM.

In all organized bodies it is necessary that a certain number of the members, called a *quorum*, should be present before any business can be transacted. This is considered essential to the end that the matter decided may fairly represent the will of the organization. The number necessary for a *quorum* may be fixed as the assembly wills; and if, at any time during the meeting, the members present fall below the required number, the meeting must be adjourned by the chair.

SPEAKING.

Matter in Speaking. — A member who has the floor is supposed to confine himself to the subject under discussion, and is not allowed to introduce irrelevant or extraneous matter; and it is the duty of the chair to call him to order, and request him to speak *to the question.* He is to use no personalities, nor any language reflecting on previous determinations of the assembly, except the pending motion be for annulling such prior legislation. The consequences of a measure may be shown in detail and denounced, but the motives of its advocates cannot be impugned.

Times of Speaking. — As a general rule, a member is not allowed to speak more than once on a question till all others who are desirious of speaking have done so; but if incidental or subsidiary motions be introduced in connection with it, they are privileged to speak again. The mover and seconder may, if they so desire, speak to the question when the motion is made and seconded, but are thus shut off from being again recognized till all others have spoken. A member may, however, rise to give an explanation, or to clear a matter of fact, or set himself right, if his statements are being misrepresented.

MOTION TO SUBSTITUTE.

Can be debated, amended, or reconsidered.

WITHDRAWAL OF A MOTION.

1. Is not debatable, but may be amended or reconsidered.
2. Must have a unanimous vote before it can be withdrawn.

TO ORGANIZE A MEETING.

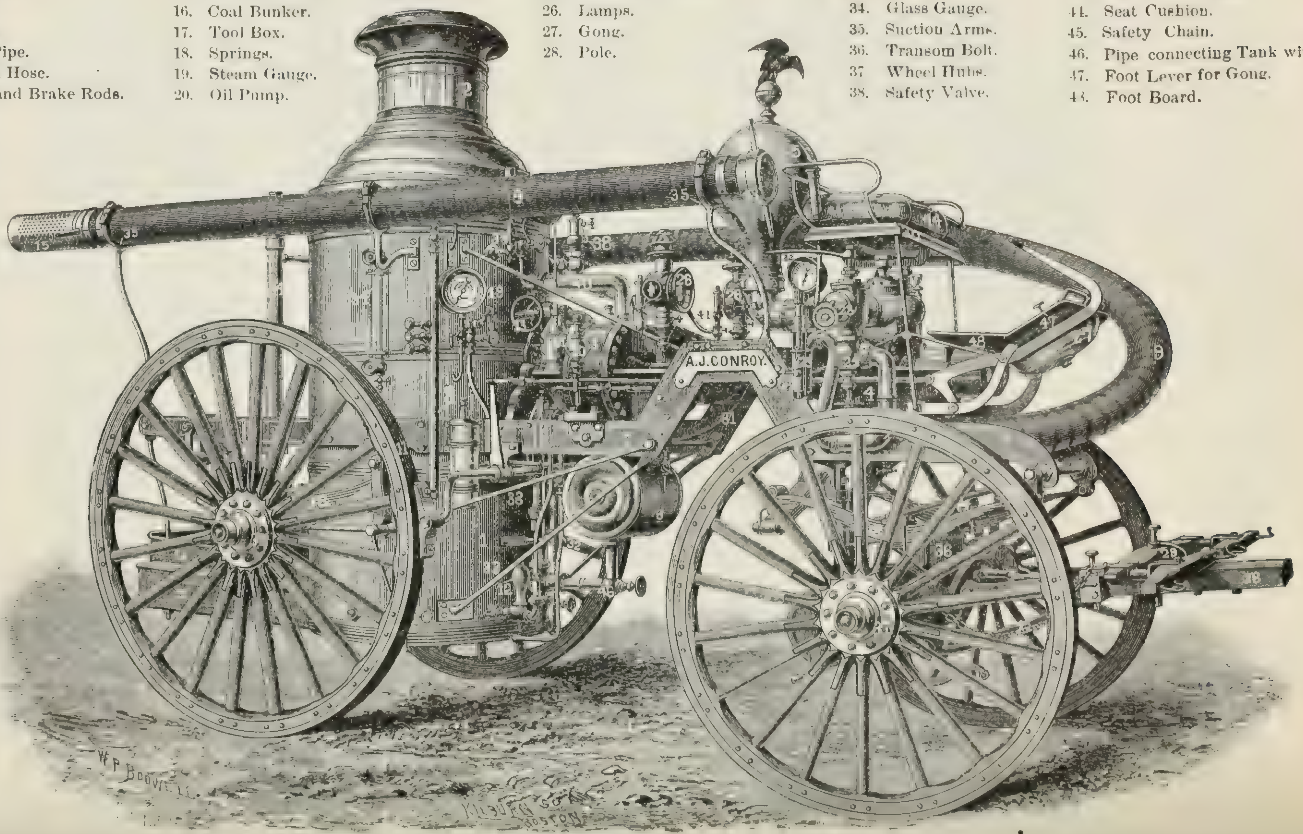
The time having arrived when the meeting had been announced to take place, some one (usually agreed upon by the conveners of the meeting) addresses the others from the platform, requesting them to come to order, and suggesting the necessity of an organization, and stating the objects of the meeting. He requests nominations for a chairman, and puts the name first heard to the meeting, which, if indorsed by a majority, the party so elected takes the chair. The chairman proceeds in the same way to the election of a secretary, or such other officers as may be requisite.

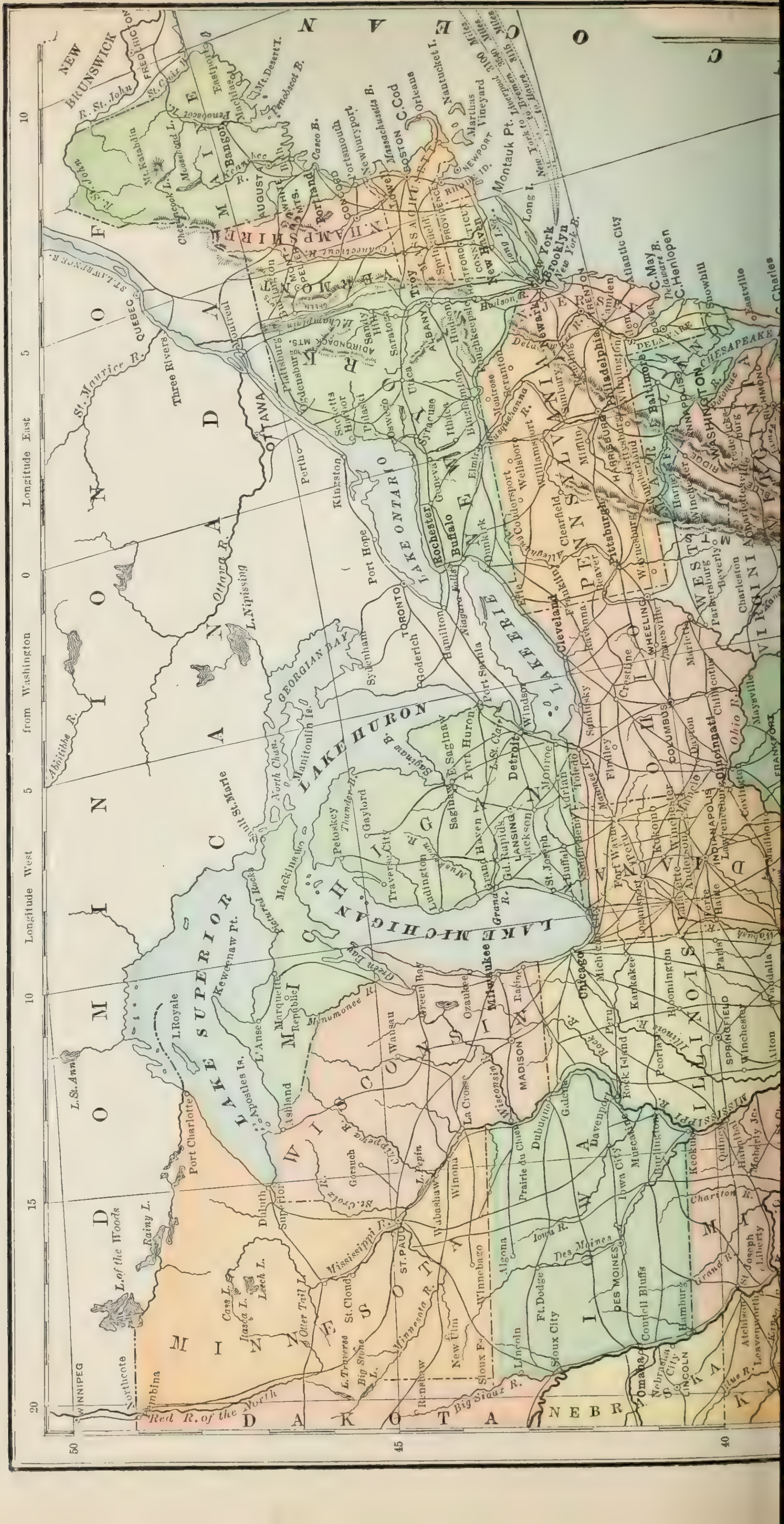
If the organization thus effected be not sufficient for the purposes intended, it is usual to consider it only as temporary, and to submit the matter of a permanent organization to a committee, upon whose report, modified or otherwise, it proceeds to organize.

In representative assemblies it is necessary, before business is transacted, to ascertain who are duly authorized as members; and for this purpose a committee on credentials is appointed, who examines the rights of rival claimants, and prepares a list of duly elected members. The investigations of this committee properly take place after the temporary and before the permanent organization, and no member should be appointed on it whose election is disputed.

In all deliberative assemblies decisions are made, as a rule, in accordance with the vote of the majority; but special rules may be made by which a less number than a majority, or a greater, is needed to express the will of the body.

1. Boiler.
2. Dome.
3. Steam Cylinder.
4. Pump.
5. Air Chamber.
6. Tank.
7. Frame.
8. Foam Pipe.
9. Suction Hose.
10. Brake and Brake Rods.
11. Wheels.
12. Force Pump.
13. Throttle Valve.
14. Street Pipe.
15. Suction Strainer.
16. Coal Bunker.
17. Tool Box.
18. Springs.
19. Steam Gauge.
20. Oil Pump.
21. Oil Cans.
22. Water Gauge.
23. Outlet Gates.
24. Relief Valve.
25. Automatic Relief.
26. Lamps.
27. Gong.
28. Pole.
29 Whiffle Trees.
30. Seat.
31. Feed Pipe.
32. Sprinkler.
33. Braces.
34. Glass Gauge.
35. Suction Arms.
36. Transom Bolt.
37 Wheel Hubs.
38. Safety Valve.
39. Whistle.
40. Exhaust Pipe.
41. Lantern Standard.
42. Oil Cups.
43. Suction Coupling.
44. Seat Cushion.
45. Safety Chain.
46. Pipe connecting Tank with Pump.
47. Foot Lever for Gong.
48. Foot Board.




DOMINION OF CANADA
NEW BRUNSWICK
MAINE
N. HAMPSHIRE
VERMONT
NEW YORK
PENNSYLVANIA
NEW JERSEY
MARYLAND
DELAWARE
WEST VIRGINIA
VIRGINIA
OHIO
INDIANA
ILLINOIS
MICHIGAN
WISCONSIN
MINNESOTA
IOWA
DAKOTA
NEBR
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
LAKE ONTARIO
GEORGIAN BAY
OCEAN
QUEBEC
Three Rivers
Montreal
OTTAWA
Kingston
TORONTO
Port Hope
Hamilton
Goderich
Sydenham
Perth
L. Nipissing
Ottawa R.
St. Maurice R.
Abitibbe R.
L. St. Ann
L. of the Woods
Rainy L.
Port Charlotte
WINNIPEG
Northcote
Pembina
Red R. of the North
Sault St. Marie
Manitoulin Is.
North Chan.
Mackinac
Petoskey
Gaylord
Traverse City
Ludington
Grand Haven
Gd. Rapids
LANSING
Jackson
Saginaw
E. Saginaw
Port Huron
Detroit
Windsor
Monroe
Adrian
Toledo
St. Joseph
South Bend
Chicago
Milwaukee
Racine
Ozaukee
Green Bay
MADISON
Wausau
La Crosse
Marquette
L'Anse
Ashland
Apostles Is.
Duluth
Superior
ST. PAUL
St. Cloud
Winona
L. Pepin
Wabashaw
Winnebago
New Ulm
Sioux F.
Big Sioux R.
Minnesota R.
Mississippi R.
Cass L.
Itasca L.
Leech L.
Otter Tail L.
L. Traverse
Big Stone L.
Algona
Ft. Dodge
Sioux City
DES MOINES
Council Bluffs
Omaha
Iowa City
Davenport
Dubuque
Burlington
Keokuk
Rock Island
Peoria
Bloomington
SPRINGFIELD
Kankakee
Peru
INDIANAPOLIS
Lafayette
Logansport
Fort Wayne
Kokomo
Richmond
Cincinnati
Dayton
COLUMBUS
Chillicothe
Sandusky
Cleveland
Findlay
Crestline
Marietta
WHEELING
Parkersburg
Charleston
Pittsburgh
Erie
Buffalo
Rochester
Dunkirk
Elmira
Binghamton
Syracuse
Oswego
Utica
ALBANY
Troy
Saratoga
Plattsburg
Ogdensburg
ADIRONDACK MTS.
Harrisburg
Philadelphia
Baltimore
WASHINGTON
ANNAPOLIS
Wilmington
DOVER
Trenton
Newark
New York
Brooklyn
Long I.
New Haven
HARTFORD
PROVIDENCE
NEWPORT
BOSTON
Springfield
Lowell
C. Cod
Nantucket I.
Marthas Vineyard
Montauk Pt.
Portsmouth
Newburyport
CONCORD
Portland
AUGUSTA
Bangor
Eastport
Mt. Desert I.
Penobscot B.
Casco B.
Mt. Katahdin
Moosehead L.
R. St. John
FREDERICTON
St. Croix R.
C. May
C. Henlopen
Atlantic City
Longitude West from Washington
Longitude East
50
45
40
20
15
10
5
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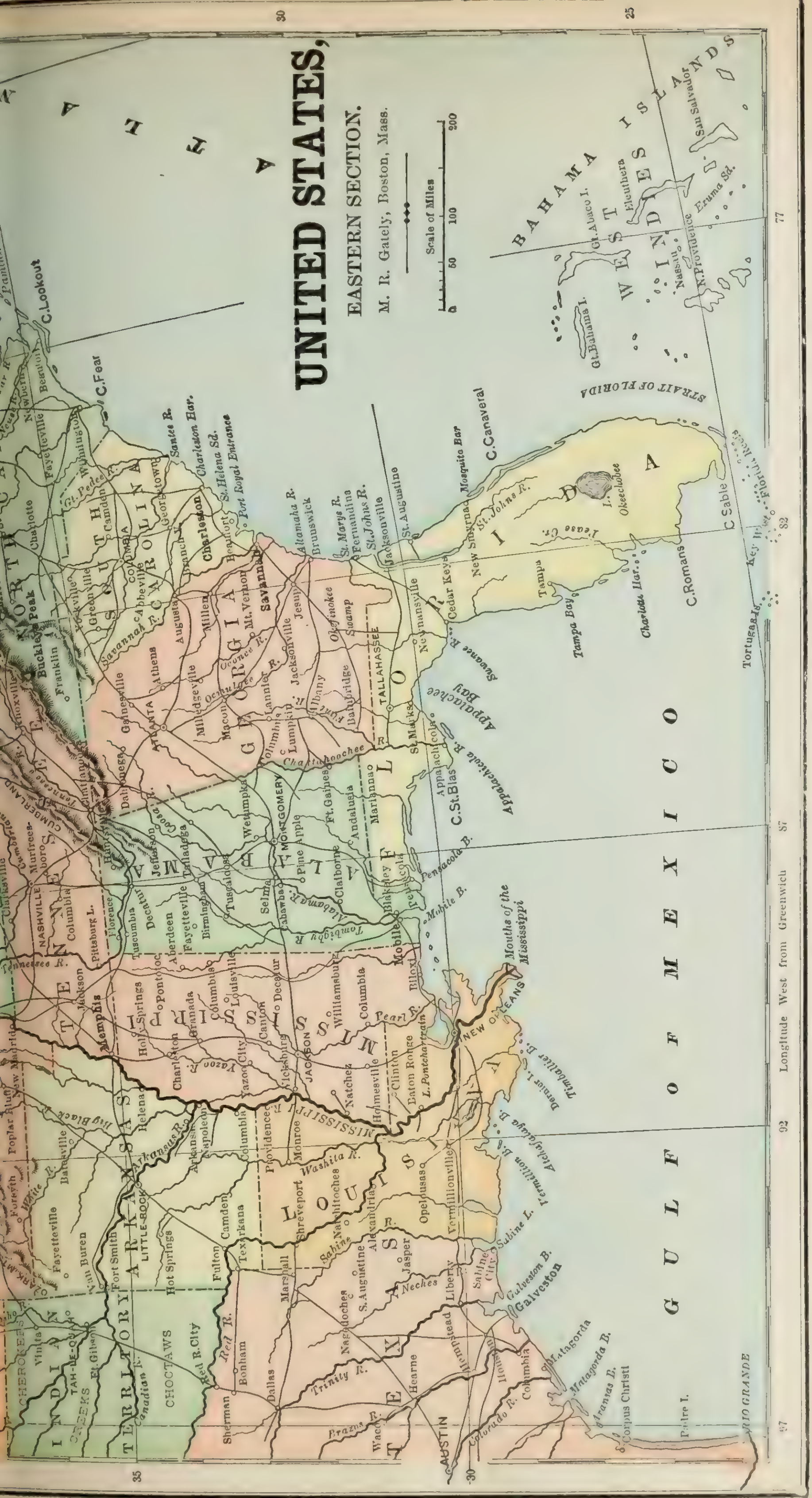
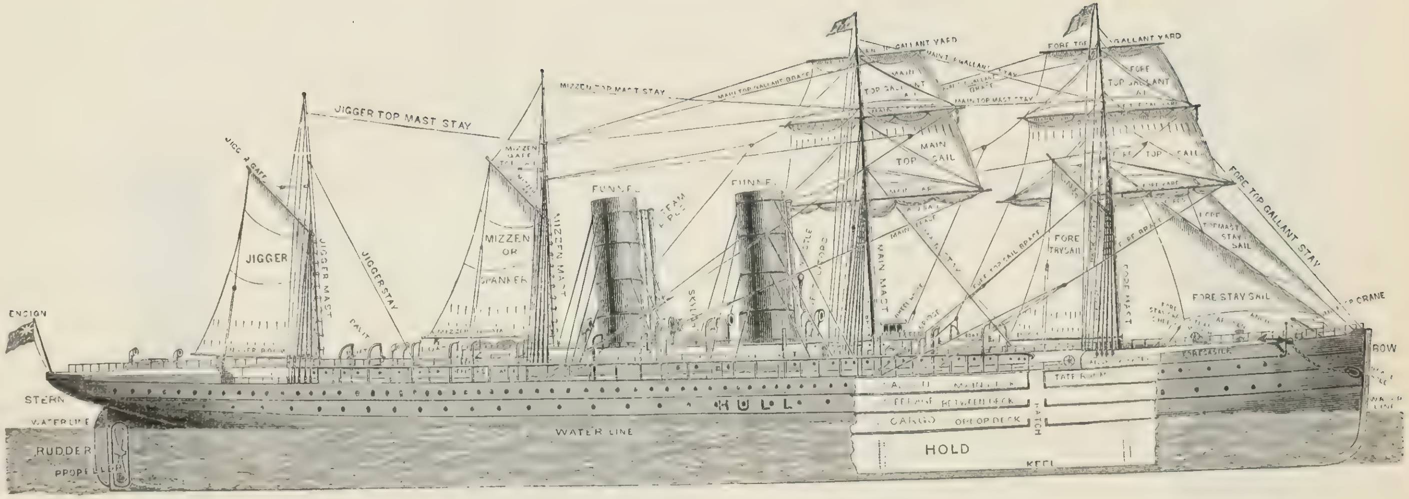
5
10

UNITED STATES,
EASTERN SECTION.
M. R. Gately, Boston, Mass.
Scale of Miles
0
50
100
200
Longitude West from Greenwich
97
92
87
82
77
35
30
25
GULF OF MEXICO
BAHAMA ISLANDS
WEST INDIES
STRAIT OF FLORIDA
FLORIDA
GEORGIA
ALABAMA
MISSISSIPPI
LOUISIANA
TEXAS
ARKANSAS
TENNESSEE
SOUTH CAROLINA
NORTH CAROLINA
INDIAN TERRITORY
CHOCTAWS
CREEKS
CHEROKEES
TALLAHASSEE
MONTGOMERY
ATLANTA
COLUMBIA
JACKSON
NASHVILLE
LITTLE ROCK
AUSTIN
NEW ORLEANS
C. Lookout
C. Fear
C. Canaveral
C. Sable
C. Romans
C. St. Blas
Charleston
Savannah
Mobile
Galveston
Pensacola
Jacksonville
St. Augustine
Tampa
Key West
Tortugas Is.
Florida Reefs
L. Okeechobee
Appalachee Bay
Tampa Bay
Charlotte Har.
Mouths of the Mississippi
Memphis
Vicksburg
Natchez
Baton Rouge
Shreveport
Dallas
Houston
Corpus Christi
Padre I.
RIO GRANDE
Gt. Abaco I.
Gt. Bahama I.
Eleuthera
Nassau
N. Providence
San Salvador
Exuma Sd.

GATELY'S UNIVERSAL EDUCATOR.

VOLUME II.

ARITHMETIC,
DRAWING AND PAINTING,
PHYSICS AND MECHANICS,
CHEMISTRY,
AGRICULTURE,
MEDICAL TREATISE.



STEAMER OREGON.- SIDE VIEW.

Dimensions, Length, 520 feet ; Beam, 54 feet ; Depth, 40 feet 9 inches.

Measurement, 7,500 tons. Horse Power, 13,000.

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m 3 Mizzen-Mast.
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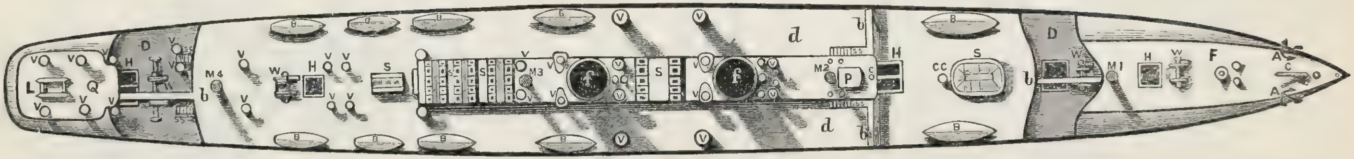


STEAMER OREGON.—DECK VIEW.

From Queenstown to New York, August 24th to August 30th, 1884, 6 days 8 hours and 42 minutes. First day, 400 miles; second day, 452 miles; third day, 454 miles; fourth day, 452 miles; fifth day, 448 miles; sixth day, 449 miles; last day, 192 miles.

From New York to Queenstown, September 3d to September 10th, 1884, 6 days 11 hours and 9 minutes.

ARITHMETIC

ARITHMETIC treats of the properties and relations of numbers, and is the art of computation by figures.

In the following pages it will be our endeavor to exhibit the *art of computation*, with so much of the *science of numbers* as may be necessary to explain the principles involved in the methods used.

That our *system of notation* was obtained from the Arabs, and consists of nine figures or characters, sometimes called digits (because the fingers were formerly used in counting), which have both a simple and a local value,—or one value when used singly, and a tenfold increased or diminished value according to relative position when used with other figures,—and a tenth character, called *naught* or *zero* or *cipher*, which only serves to indicate the local position of the digits, is universally known, and we merely mention it as an introduction of the characters whose uses we are to consider.

In writing numbers the following basis has received universal sanction:—

That *whole* numbers shall commence with units at the right, and increase in value ten times for each removal one place toward the left.

That a *decimal* shall commence with a period, which in connection with a whole number must be put at the right of units, and that each figure of the decimal shall decrease in value ten times for each removal one place toward the right.

That numbers, whether whole or decimal, *increase* in value from right to left and *decrease* in value from left to right.

From the last statement it follows that in learning to write numbers it is proper to write whole numbers and decimals at the same time, and thus at once be rid of the dread and imaginary difficulty of *decimal fractions*, so called.

The learner simply needs to consider the fact that a *decimal* is only a continuation in the tenfold decrease of a whole number as its figures are removed to the right of the period, called the *decimal point;* hence for any operation performed upon it, it may be treated as a whole number, until the single operation is complete. For this reason we shall use whole numbers and decimals throughout the simple rules.

In writing numbers the simplest method is to begin at the left, as if to read the number, and, using the French method of numeration in dividing the number into periods of three figures each, fill each period properly, in its order, as you go toward the right. To do this it is necessary to know the names of the periods in their order, from the highest to the lowest in common use.

The following table exhibits the necessary terms: —

Hundreds of Quadrillions.	Tens of Quadrillions.	Units of Quadrillions.	Hundreds of Trillions.	Tens of Trillions.	Units of Trillions.	Hundreds of Billions.	Tens of Billions.	Units of Billions.	Hundreds of Millions.	Tens of Millions.	Units of Millions.	Hundreds of Thousands.	Tens of Thousands.	Units of Thousands.	Hundreds.	Tens.	Units.	Tenths.	Hundredths.	Thousandths.	Ten-Thousandths.	Hundred-Thousandths.	Millionths.
4	5	6,	7	8	9,	1	2	3,	4	5	6,	7	8	9,	1	2	3	.4	5	6,	7	8	9.
Quadrillions.			Trillions.			Billions.			Millions.			Thousands.			Units.			Thousandths.			Millionths.		

The numbers forming a part of the above table may be read as follows: Four hundred fifty-six quadrillion, seven hundred eighty-nine trillion, one hundred twenty-three billion, four hundred fifty-six million, seven hundred eighty-nine thousand, one hundred twenty-three, *and* four hundred fifty-six thousand, seven hundred eighty-nine millionths.

In reading a whole number and decimal we use the conjunction *and* only to connect the whole number and decimal, because it might render the meaning doubtful if used in other parts of the number. Thus, fifty thousand and five hundred thousandths might be considered 50,000.00005 instead of .50005, or *vice versa*, if no discrimination were made in the use of *and.*

If now we wish to write in figures the number above written in words, we commence with the left-hand period, four hundred fifty-six quadrillion, and write it as seen in the table, pointing off the three figures as a completed period; and then, in like manner, fill the next period, and so on to units, attaching to each period, in mind, its name as we write, and not further noticing it, other than to bring next to it the proper period. We know when we have reached the decimal by the conjunction *and.* We place after the last period thus far written the decimal point (.), and then write the first period following the word *and* as though it were a whole number, four hundred fifty-six thousand, 456, in mind considering the period *thousands*, and follow it by the next period, 789, making .456,789, — which is all millionths, because the last period, 789, is in millionths period, the name of the decimal always being that of the right-hand figure.

If any part or the whole of a period of whole numbers or decimals has no significant figure, fill the places with ciphers.

The Roman method of notation is only used in numbering sections, chapters, and general divisions of books, and on the faces of clocks, watches, etc., to indicate hours, etc.

This method involves the use of seven capital letters, as follows: —

I	V	X	L	C	D	M
One.	Five.	Ten.	Fifty.	One Hundred.	Five Hundred.	One Thousand.

Intervening and following numbers are expressed by repetitions and combinations of these letters. Thus, two is II; four is IV, that is, one from five; six is VI, that is, five and one; forty is XL; sixty, LX; and so on.

The system is at once apparent, which is, that letters of like value used side by side simply add their values; that a letter of less value before one of greater value decreases the larger by the smaller value; and that a letter of smaller value placed after one of larger value increases the larger number by the value of the smaller.

A dash, —, placed over a letter, increases the value of the letter *one thousand times;* $\overline{\text{VI}}$, *six thousand.*

One thousand was formerly represented by CIↃ, which was finally contracted to M. The prefixing of a C, and the annexing of inverted C to CIↃ, increased it ten times; thus, CCIↃↃ represented *ten thousand*, and this similarly treated made *one hundred thousand*, and so on.

ARITHMETICAL SIGNS.

THE SIGNS are used to indicate operations or shorten expressions.

The *sign of addition*, +, called *plus*, indicates that the quantities between which it is placed are to be united in one sum.

The *sign of subtraction*, —, called *minus*, indicates that the quantity at its right is to be taken from the quantity at its left.

The *sign of multiplication*. ×, indicates that the quantities between which it is placed are to be multiplied together.

The *sign of division*, ÷, indicates that the quantity placed at its left is to be divided by the quantity at its right.

The *sign of equality*, =, indicates that the quantities between which it is placed are equal.

The *dollar sign*, $, is written before numbers to obviate the necessity of writing the word *dollars*. The sign was originally, let us imagine, capital U written over capital S, for U. S., abbreviation of United States.

£ is the sign for the English pound sterling.
7/6 signifies 7 shillings 6 pence.
6/2 signifies 6 shillings 2 pence.
6/2½ signifies 6 shillings 2½ pence.
1^1 signifies one and one fourth.
1^2 signifies one and one half.
1^3 signifies one and three fourths.
% signifies *per cent.*
$\sqrt{}$ or $\sqrt[2]{}$ signifies *square root of.*
$\sqrt[3]{}$ signifies *cube root of.*
( ) indicates that all within the curves is to be operated as one quantity.
# is sometimes used for the word *number*.

ADDITION.

Addition is the process of uniting two or more numbers, to find the *sum* of their combined units. The result is called the *amount*.

It should be remembered that all numbers, however large or small, represent so many *units* or parts of a unit, and that in all arithmetical processes, we, in the result, obtain always one or more *units* or parts of units of some kind. If it has no reference to any particular thing, but simply represents quantity, it is called a *simple* or *abstract* unit; as, 1, 200, 225.5. When this simple unit is attached to any particular class of objects, it is called a concrete unit; as, 1 horse, 3 apples, 30 pounds.

If we unite simple units, of course the result will be simple units, and if we unite concrete units, the result will be concrete units: thus, 1 and 5 and 10, united, make 16; but 5 horses and 7 horses and 10 horses make, in number, 22 horses. In addition, then, as in all arithmetical operations, we must bear in mind the kind of unit we are using in order to determine the result.

The *sign of addition*, +, called *plus*, is used to represent the addition of numbers when written one after another, in the same line, thus: $6+7+5+4+11=33$.

The *sign of equality*, =, signifies the equal value of the quantities at the right and left of itself.

The process of addition may be represented as follows: —

Required the sum of 245.05 + 1234.5678 + 87.654 + 1479.5 + 3000.00005.

OPERATION.
245.05
1234.5678
87.654
1479.5
3000.00005
———
6046.77185

In writing the numbers for addition, whether whole or decimal, place the orders of one number directly under the same orders of the number above it; that is, units under units, tens under tens, tenths under tenths, and so on. The decimal point of each number will then be in a perpendicular line with the other decimal points; and in the result, all at the right of it will be decimal, and all at the left whole numbers. We now add the right-hand column, and if the sum occupies more than one place, put the right-hand figure of the sum directly under the column added; the other figure or figures of the sum represent so many units of the next left-hand or higher order, because each order to the left is tenfold the value of the next right-hand order. Instead of at once writing down the right-hand figure of the sum of any order, we may divide the sum by ten to find how many units of the next higher order it contains; but we shall find so many tens in the sum as are represented by its figures with the right-hand one removed, and each of these tens equals a unit of the next left-hand order. This principle applies to all orders of numbers.

Hence we add the number of units, thus found, of the next left-hand order, to the sum of that column, put the right-hand figure of this sum under its column, and so continue until we have added the left-hand column, when we write down the whole sum as representing so many units of that order.

In the example, the right-hand column contains only 5 units of that order, hence we write it underneath; the next left-hand column contains 8 units of that order, and is written underneath accordingly; but the third column to the left contains 11 units of that order, or 1 unit of the next higher order, and 1 of its own, and we write its own unit underneath, and add the unit of the next higher order to its column. The fourth column contains 17 of its own units, or 1 of the next higher order and 7 of its own; the 7 we write underneath, and add the unit of higher order to its column, which also contains 1 unit of higher order and 7 of its own; and we write down the 7, and add the 1 to its order, which contains 26 of its own units, or 2 units of the next higher order and 6 of its own; we write down the 6, and add the 2 to its order, the next left-hand column. We continue the process until all the columns have been added, and set down the sum of the last column. We have already put the decimal point in its place under those above, and have the same number of figures on its right as found in the most extended decimal of the numbers added.

We have thus explained the principle of uniting large numbers because it is at the base of all arithmetical calculations.

Taking it for granted that the reader is accustomed to simple mental calculations, we give here the best *methods* for adding single and double columns of figures: —

Begin at the bottom of the column and add upward, mentioning *results* only, thus: 12, 16, 22, 27, 31, etc. After a little practice the accountant finds it as easy to unite three or four figures at one time, and does so almost as quickly as he can add two at a time, for he saves the time occupied in mentally or orally accenting so many results. He may add thus by a glance of his eye up the column such combinations of figures as are most readily united.

The above example, for instance, may be added thus: 12, 22, 31, 46, 55, 64, 79, 94, 103, 116. In order not to burden the mind, when long columns are to be added, as each hundred is reached it will be well to note the amount opposite the last figure entering into its sum, as shown in the example, and then begin to add again from that point, and so on, finally uniting these results.

The best method of *proof* is that usually employed by business men; viz., beginning at the top and adding down the column. The order of the figures is thus reversed, and if the result is like the first, it may be safely assumed to be correct; for the *same* error, if there were one, would not be likely to occur in the reversed order.

After practice as above, double columns may be added with almost as much rapidity as single columns, noting each one thousand as one hundred is above noted.

OPERATION.
7
6
9 103
6
9
8
7
5
4
3
6
7
8
4
5
6
1
3
5
7
——
116

SUBTRACTION.

Subtraction is the process of taking one number from another to find their difference. The larger number is called the *minuend*, because it is the number diminished. The smaller number is called the *subtrahend*, because it is taken from the other number. The result of the process is called the *difference* or *remainder*.

The sign of subtraction, —, called *minus*, is placed between numbers to show that what follows is to be taken from what precedes.

The process is the reverse of addition, and may be explained as follows: —

OPERATION.

9034.5315	minuend.
7852.6108	subtrahend.
1181.9207	remainder.

We write the numbers — the less under the greater — units under units, tenths under tenths, etc., as in addition; then begin at the right hand to subtract. Since 8 units of the right-hand order are more than 5 units, we cannot take the former from the latter, but must reduce a unit of the next higher order of the minuend to units of the right-hand order, of which it equals 10, which added to the 5 of the right-hand order makes 15, from which we subtract 8; and the remainder, 7, we write as units of the right-hand order. As we have taken away the only unit of the second order in the minuend, nothing remains, and as nothing is to be taken from it, we write a cipher in the remainder. 1 unit of the next order from 3 units of the same order leaves 2 units, which we place in its order in the remainder. In the fourth order we find the same difficulty that existed in the first, and we treat it in like manner, obtaining 15 units of that order, 9 being taken from which leaves 6. 1 unit having been taken from the fifth order of the minuend to make 10 of the fourth order, only 3 units are left, from which we take the 2 of the subtrahend, leaving 1. Between the 9 and 1 we place the decimal point, directly beneath those above. In the sixth order, the figure of the subtrahend is larger than the corresponding figure of the minuend, but we cannot provide for this case as in the first and fourth orders, because there are no units of the seventh order; we must therefore go two places to the left to the eighth order, and reduce one of its units to units of the seventh order, of which it equals 10; as we now have units of the seventh order, we can use one as in previous cases, making 13 of the sixth order from which to take the 5 of the subtrahend, leaving 8. Having used 1 of the 10 units which we obtained for the seventh order, 9 only remain, from which to take the 8 of the subtrahend, leaving 1. We have already taken 1 unit from the last order of the minuend, and only 8 remain from which to take the 7 of the subtrahend, leaving 1.

To PROVE the correctness of our result, we have only to add the subtrahend and remainder together, and if the result is like the minuend the work is correct.

The reason for this is that general principle that the whole of anything is equal to the sum of all its parts.

MULTIPLICATION.

Multiplication is a short method of adding a given number of units to the same number of units as many times as there are units in another number; or it is the process of increasing a number as many times itself as another number has units. The number thus increased is called the MULTIPLICAND.

The number whose units represent the times the multiplicand has been or is to be thus increased is called the MULTIPLIER.

The result of the operation is called the PRODUCT.

The *product* must be of the same kind as the *multiplicand*, as the definition of multiplication indicates.

We cannot multiply one kind of thing by another kind of thing; that is, a concrete number by a concrete number. The multiplier must be an abstract number; *i. e.*, representing units simply. Thus, if we wish to know the aggregate cost of 6 books at 4 dollars each, we cannot multiply books by dollars, but must multiply 4 dollars by 6 units. If 1 *book* cost 4 *dollars*, 6 books will cost 6 *times* 4 dollars, or 4 dollars × 6 = 24 dollars.

The *sign of multiplication*, ×, indicates that the quantity which precedes it is to be multiplied by the number following.

The following examples exhibit the processes of multiplication applicable to various cases: —

1. Multiplication of a quantity by a single figure.

456.7891 × 5 = what?

OPERATION.

456.7891	multiplicand.
5	multiplier.
2283.9455	product.

We, for convenience, place the multiplier directly under the right-hand order of the multiplicand, because we, in natural order of increase, move from right to left; and in this case we propose to increase the multiplicand five times itself. Draw a straight line to separate the product from the multiplier. 1 × 5 = 5 units of the right-hand or first order, and we place the 5 directly beneath the multiplier, or right-hand order; 9 × 5 = 45 units of the second order, or 4 units of the third and 5 of the second order, since 10 units of the second order make 1 unit of the third; therefore we write the 5 units of the second order under that order of the multiplicand, and add the 4 units of the third order to the product of that order of the multiplicand, thus: 8 × 5 = 40 + 4 = 44 units of the third order, or 4 units of the fourth order and 4 of the third. We write the 4 of the third order under its order, and add the 4 of the fourth order to the product of that order of the multiplicand, thus: $7 \times 5 = 35 + 4 = 39$ units of the fourth order, or 3 of the fifth order and 9 of the fourth. We write the 9 under its order and add the 3 to the next product; and so continue until the last product, which we write at the left as units of the last period.

Between the 9 and 3 of the product, directly under the decimal point of the multiplicand, we put a decimal point, having the same number of figures to the right of it as are at its right in the multiplicand.

Thus we see that it is just as simple to multiply a whole number and decimal united as to multiply a whole number only; and the only consideration given to the decimal is to put the point in the proper place in the product as above shown.

2. Multiplication of a quantity by a number consisting of several figures.

$231.252 \times 4.56 =$ what?

The multiplier in this case has figures of three orders, and each order increases at tenfold rate from right to left; hence the multiplication of each figure of the multiplicand is increased tenfold as the figure by which the multiplication is performed is removed one place farther to the left in the multiplier. Accordingly the right-hand figure of each separate product, resulting from the multiplication of the multiplicand by the individual figures of the multiplier, should be put directly under the figure of the multiplier producing that product. Thus, in the example, 2, the right-hand figure of the product of the multiplicand by 6, is put under 6; 0, the right-hand figure of the product of the multiplicand by 5, is put under the 5 of the multiplier; and 8, the right-hand figure of the product by 4, is put under the 4 of the multiplier.

OPERATION.

$$\begin{array}{r} 231.252 \\ 4.56 \\ \hline 1387512 \\ 1156260 \\ 925008 \\ \hline 1054.50912 \end{array}$$

These partial products are then united, as in addition, into one sum, which is placed in proper order beneath a line drawn under the partial products.

We have now to notice the fact that the multiplier was not a whole number, but part decimal, and the multiplication by the decimal part must produce a corresponding decimal part in the product; hence that if the multiplicand were a *whole* number, there would be two decimal places in the product: but we found in the preceding example, where the multiplier was a whole number, that there must be as many decimal places in the product as in the multiplicand. In *this* case the number of decimal places in the product must be two plus the number in the multiplicand, or $2 + 3 = 5$. We therefore place the decimal point so that five figures will be at its right. This placing of the decimal point is called *pointing off;* and as an invariable rule for it, we may say that *there must be pointed off at the right for decimals, in the product, as many figures or orders as there are decimal places in both multiplicand and multiplier.*

The reason for this will be apparent if the reader will consider for a moment that a decimal is a tenth, or hundredth, etc., *part of a unit;* hence that the multiplication by it is only the taking of the tenth or hundredth, etc., part of the quantity multiplied.

3. To multiply by a whole number of tens, hundreds, thousands, as 10, 400, 4,000, etc., put the right-hand *significant* figure or figures of the multiplier under the right-hand figure of the multiplicand, multiply as in preceding examples, and annex the ciphers of the multiplier. If decimals occur in the multiplicand, point off as many in the product as are in the multiplicand.

The business method of *proof* is *to divide the product by the multiplier*, and if the quotient is like the multiplicand the work is right.

OPERATION.

$$\begin{array}{r} 5.600 \\ 4000 \\ \hline 22400.000 \end{array}$$

There are various methods of shortening the process of multiplication, but only a few of them are of practical use; and those which follow are the simplest contractions. The reader will be able to understand them after having read division. 2½ is one fourth of ten; hence, if we wish to multiply by 2½, it is only necessary to annex a cipher to the multiplicand, which is thus multiplied by 10, and then divide by 4. Thus, multiply 4562 by 2½.

OPERATION.

4) 45620

11405

3⅓ is one third of ten; 33⅓ is one third of 100; 333⅓ is one third of 1,000: to multiply a number by them respectively, it is only necessary to annex one, two, and three ciphers respectively to that number, and divide by 3. Thus, multiply 6456 by 3⅓, 33⅓, and 333⅓.

OPERATION.

3) 64560	3) 645600	3) 6456000
21520	215200	2152000

12½ is one eighth of 100; hence, to multiply a number by it, we have only to annex two ciphers to the number and divide by 8. Thus, multiply 9648 by 12½.

OPERATION.

8) 964800

120600

16⅔ is one sixth of 100; and to multiply by it, it is only necessary to annex two ciphers and divide by 6.

In like manner we can multiply by 25, which is one fourth of 100; and by 125, which is one eighth of 1,000.

DIVISION.

Division is the direct opposite of multiplication, and is a short process of ascertaining how many times one number has been used in forming another, or how many times one number must be multiplied into itself to produce another number; it is also a short method of performing subtractions, or of determining the number of times one quantity must be taken from another quantity, that nothing may remain.

The number divided is called the DIVIDEND; the number by which we divide is called the DIVISOR; the result of the division is called the QUOTIENT. When the division is not exact, there will be a remainder.

The *sign of division*, ÷, indicates the division of the number which precedes it by the number which follows it.

Division is also indicated by writing the dividend above and the divisor below the same horizontal line, thus: $\frac{10}{2} = 5$.

In arranging the dividend and divisor for the process of division, the divisor is placed at the left of the dividend with a curve between, thus: 2) 4568. If the divisor is small, so that the operation can be readily carried in the mind, a line is drawn beneath the dividend, and the quotient is placed beneath it, as in the accompanying operation.

OPERATION.

2) 4568

2284

If this cannot be easily done, the quotient is written at the right of the dividend, thus: 285) 84645 (297; and the operation performed by successive steps, as illustrated further on. The first method is called SHORT DIVISION, and the second method is called LONG DIVISION.

When the divisor and dividend are of the same kind, the quotient represents only the number of *times* the divisor is contained in the dividend. Thus, 6 cents are contained in 36 cents, 6 times, for cents = cents; hence the division is the same as dividing one abstract number by another.

When the divisor and dividend are of different kinds, the divisor must always be considered an abstract number, and the quotient will represent the number of parts of the same kind into which the dividend has been divided. Thus, if twenty-four oranges be equally divided among four persons, each person will have as many oranges as 4 is contained times in 24, or 24 oranges ÷ 4 = 6 oranges. If there be a remainder, it will be of the same kind as the dividend.

The process of short division is as follows: —

OPERATION.

Divisor 5) 636.535 dividend.
127.307 quotient.

For convenience in reducing remainders to the next lower order when any order is not exactly divided, we commence by dividing the left-hand order or orders, according as one or more may be necessary to contain the divisor. In the example, the left-hand order, 6, contains the divisor, 5, *one* time, and we write 1 in the quotient directly under its order, 6. There is also one unit of that order remaining, which cannot be divided by 5; hence we reduce it to units of the next right-hand order, of which it equals ten; 10 + 3 = 13 of this order, which contains the divisor two times, and we write the 2 under its order. The remainder, 3, we reduce to units of the next lower order, of which it equals thirty, or 10 times 3; 30 + 6 = 36 units of this order to be divided by 5; 36 contains 5 seven times, and we write 7 beneath its order in the dividend. There is one unit of this order remaining, which equals ten of the next lower order, and this added to the 5 of that order makes 15, which contains the divisor exactly three times; and we write 3 in the quotient in its order. There are only *three* units of the next lower order, and they cannot be divided by 5, hence we write a cipher in the quotient. These three units can, however, be reduced to units of the next lower order, of which they equal thirty, or 10 times 3; 30 + 5 = 35 units of the last order, which contain the divisor exactly seven times, hence 7 is the last figure of the quotient.

We have apparently been dividing a whole number, though a part of it is decimal; hence we see that it is not necessary to consider the decimal in such case until the division is performed, when we put a point between 7 and 3 of the quotient, and directly beneath the point in the dividend, thus making the same number of decimal places in the quotient as in the dividend, which is right; and this will always be the case when a decimal is divided by a whole number, and there is no remainder. If there be a remainder and the division be further continued, there will be as many additional decimal places as there are ciphers annexed for the continuation of the division.

For the division of large numbers by large numbers, it is necessary to use *long division*, because it is difficult to keep the operation in the mind; but the principle is precisely as above explained.

We have seen that the division of any order by abstract units yields a number of that order, and that the division of any order by its own order yields abstract units; hence the division of a decimal by a smaller decimal of that order will produce abstract units. Thus, .6 ÷ .2 = 3, which is a whole number. Therefore if the *dividend* have the *same* number of decimal places as the *divisor*, the quotient will be a whole number; and if it have a *less* number than the divisor, we can obtain the quotient as a whole number by annexing ciphers to the dividend until its decimal places *equal* those of the divisor, and by using them all in the division. If the decimal places of the dividend *exceed* those of the divisor, the decimal places of the quotient will equal that excess. Thus, if there be two more decimal places in the dividend than in the divisor, there will be two decimal places in the quotient; if three more in the dividend, three in the quotient; and so on. If the division be carried beyond the regular places of the dividend, each additional figure thus used will add a decimal place to the quotient.

Divide 252070.520751 by 591.57.

OPERATION.

```
591.57) 252070.520751 (426.1043 quotient.
        236628
        ------
         154425
         118314
         ------
          361112
          354942
          ------
            61700
            59157
            -----
            254375
            236628
            ------
             177471
             177471
             ------
                  0
```

In performing the operation, we find that the first five figures of the dividend do not contain the divisor; hence, considering them as units of the fifth order toward the right, we reduce them to units of the sixth order by considering them multiplied by ten, which would be done by annexing a cipher, or, which is the same thing, using them in connection with the sixth figure of the dividend as units of that order. The divisor is then contained in the first six orders of the dividend four times; we write the 4 at the right for convenience, as the left-hand order of the quotient. To ascertain how much remains, we multiply the divisor by the quotient figure 4, and write the result underneath the six orders of the dividend used in obtaining that quotient figure, and perform the subtraction. We then reduce this remainder to units of the next order by considering it multiplied by ten, to which result we add the units of that order in the dividend. This is very simply done by placing the dividend figure 5 at the right of the remainder. The divisor is contained in the units of this order thus obtained two times; and we write the 2 as the second figure of the quotient at the right of the 4. We then multiply the divisor to the quotient figure thus found, 2, and subtract the result as before. We continue in this manner until we have used the last figure of the dividend. In the third from the last reduction, after annexing 7, we find the divisor is not contained in the units of this order; hence we place a cipher in the quotient and reduce the units of this order to the next, by annexing the next figure, 5, of the dividend. In the number of units of this order thus obtained, the divisor is contained four times, and we write the 4 after the cipher in the quotient. We have thus far considered the divisor and dividend as whole numbers, while in fact both contain decimals. As we have previously learned, if there were only the same number of decimals in the dividend as in the divisor the quotient would be a whole number; but there are four more decimal places in the dividend than in the divisor, hence we must point off four figures at the right of the quotient for decimals.

The usual and best method of *proof* is to multiply the divisor by the quotient, and if the product is like the dividend the work is right; unless there were a remainder, in which case the remainder must be added to the product to equal the dividend.

If it be desirable to obtain the *exact* quotient instead of decimal approximations, the remainder may be represented as divided by the divisor, by writing the divisor beneath it with a line between, and this result annexed to the quotient. Thus,

OPERATION.

```
15) 4567 (304 7/15
    45
    --
      67
      60
      --
       7
```

Contractions in division may be used in precisely the same cases as in multiplication by reversing the operation; that is, by multiplying the dividend by such a number as represents what part the divisor is of 10 or 100 or 1000, and then pointing off as many places at the right of the product as there are ciphers in the number of

OPERATION.

```
123.456
      4
-------
4.93824
```

which the divisor is considered a part. Thus, to divide 123.456 by 25, multiply by 4, and divide by 100 or point off 2 places. As there are three decimal places in the dividend already, two more will make five to point off in the quotient.

From what has been said, it will be evident that the value of the quotient depends upon the *relative* values of the divisor and dividend. It follows, therefore, —

That if both divisor and dividend be increased or diminished the same number of times, the quotient will not be changed. Thus, if 5 be the divisor and 25 the dividend, and both be multiplied or both divided by 5 before dividing the one by the other, the quotient will be the same in all three cases; as, $25 \div 5 = 5$; $5 \div 1 = 5$; and $125 \div 25 = 5$.

That if the divisor be multiplied or the dividend divided by any number, the quotient will be the same number of times smaller. Thus, if 9 be the divisor and 81 the dividend, and the divisor be multiplied or the dividend divided by 3, the quotient will be divided by 3; as, $81 \div 9 = 9$; $81 \div 27 = 3$; $27 \div 9 = 3$; and $9 \div 3 = 3$.

That if the divisor be divided or the dividend multiplied by any number, the quotient will be increased the same number of times. Thus, if in the above case 81 be multiplied by 3, or 9 be divided by 3, the quotient 9 will be multiplied by 3; as, $243 \div 9 = 27$; $81 \div 3 = 27$; and $9 \times 3 = 27$.

PROPERTIES OF NUMBERS.

When one number contains another an *exact* number of times — *i. e.*, when no *remainder* occurs — the one is said to be *divisible* by the other.

Numbers are said to be EVEN when divisible by 2, and ODD when not divisible by 2.

A PRIME number is divisible only by *itself* and 1; as, 1, 2, 3, 5, 7, 11, 13, 17.

A COMPOSITE number is divisible by other numbers besides itself and 1; as, 8, 10, 12.

A FACTOR of a number is an *exact divisor* of that number.

A number equals the product of its factors.

The factors of a number are PRIME factors when they are *prime numbers.*

FACTORING is the process of separating numbers into their factors.

Numbers are prime to each other (though neither is itself a prime number) when they have no like factor. Any number, not itself prime, may be resolved into prime factors.

NOTE. — The only *even* prime number is 2.

Every number the sum of whose figures can be exactly divided by 3 *is itself divisible by* 3; as, 3471 is divisible by 3, since 15, the sum of its figures, can be divided by 3 without remainder.

Every number whose two right-hand figures are divisible by 4 *or any factor of* 100 *is itself divisible by that factor.* That is, a factor of 100 is a factor of any number of hundreds.

Every number whose three right-hand figures are divisible by 8 *or any factor of* 1000 *is itself divisible by that factor.* That is, a factor of 1000 is a factor of any number of thousands.

Every number whose unit figure is 0 *or* 5 *is divisible by* 5.

Every even number which is divisible by 3 is divisible by 6.

No general rule can be given for 7 other than the following, which is also applicable to 11 and 13: —

Every number consisting of four places, the first and last orders of which are like significant figures, and the middle orders ciphers, is divisible by 7, 11, *and* 13; *as,* 3003, 1001, etc.

Every number whose united digits are divisible by 90, *is divisible by* 9.

Since any number of tens, hundreds, thousands, etc., is divisible by 9, with a remainder in units equal to the significant figures occupying the tens, hundreds, etc., places, thus: 6237 = 6000 + 200 + 30 + 7; and as 1000, 100, 10, divided by 9, leave a remainder of 1 in each case, the remainders occurring by the division of 6000, 200, and 30 by 9 will be 6 times 1, 2 times 1, and 3 times 1; and these remainders, together with the 7 in units place, are the same as the significant figures in the number 6237. But 6 + 2 + 3 + 7 = 18, the sum of the remainders; and as this sum is divisible by 9, the whole number is divisible by 9.

The prime factors of a number may be found by dividing the number, its quotient, and succeeding quotients resulting from the successive divisions, by any prime divisor greater than 1, and continuing the divisions until a prime number is obtained for a quotient; the divisors and last quotient will be the prime factors.

What are the prime factors of 60?

OPERATION.

2) 60
——
2) 30
——
3) 15
——
5

Ans. 2, 2, 3, 5.

In the operation we have followed the directions above given, and obtain as a result 2, 2, 3, and 5 as the prime factors of 60. The proof is the continued multiplication of these factors. Thus, 2 × 2 × 3 × 5 = 60.

A COMMON DIVISOR of two or more numbers is a number that will exactly divide them.

The GREATEST COMMON DIVISOR of two or more numbers is the largest number that will exactly divide them; or it is the product of all the prime factors common to all the numbers. Thus, 6 is the greatest common divisor of 12, 18, 30, and 42.

OPERATION.

12 = 2 × 2 × 3
18 = 2 × 3 × 3
30 = 2 × 3 × 5
42 = 2 × 3 × 7
Ans. 2 × 3 = 6.

Having resolved the numbers into their prime factors, we consider which enter into *each* number as factors; their product will be the divisor sought. In the operation we find that 2 enters as a factor into all the numbers only once, as does 3, although it is a factor of one of them two times. 5 and 7 are not common to all the numbers. The greatest common divisor therefore must be 6, the product of the common factors 3 and 2.

When the numbers are large, the simple method of obtaining the greatest common divisor is to *divide one number by another, and the divisor by the remainder, and continue dividing the last divisor by the last remainder until there is no remainder. The last divisor will be the greatest common divisor of the two numbers.*

If there be more than two numbers, proceed as above with two of them, and then in the same manner with the divisor found and a third number, and so on until all the numbers have been used. The last divisor will be the greatest divisor of all the numbers.

What is the greatest common divisor of 42, 96, 134, 256?

OPERATION.

42) 96 (2
84
—
12) 42 (3
36
—
6) 12 (2
12

6) 134 (22
12
—
14
12
—
2) 6 (3
6

Ans. 2) 256
——
128

The last divisor, hence the greatest common divisor, is 2.

The principle involved in this method is that *a divisor of the divisor and remainder must be a divisor of the dividend*, because the dividend is a certain number of times the divisor added to the remainder.

A MULTIPLE of a number is one or more times that number; that is, contains one or more times all its prime factors, and is divisible by the number.

A COMMON MULTIPLE of two or more numbers is a certain number of times each of them, and is divisible by each one.

The LEAST COMMON MULTIPLE of two or more numbers is the least multiple of the largest of these numbers which is divisible by each of the other numbers, and equals the product of their greatest common divisor by the factors of each number not common to all the numbers. It contains each prime factor of all the numbers only the greatest number of times it is a factor of any *one* of them. Thus, 720 (the least common multiple of 8, 16, 36, and 40) is the product of 2, taken 4 times as a factor, by 3, taken twice as a factor, and 5 taken once.

The greatest number of times 2 enters as a factor in any of the numbers is four, which occurs in 16; hence we use 2 four times; 3 occurs two times in 36, hence we use it two times; 5 occurs once in 40, and we use it once.

$2 \times 2 = 4$, the greatest common divisor, since 2 is the only factor common to all the numbers, and it is common two times. We see thus the truth of the statement that the least common multiple is the product of the greatest common divisor by the factors of each not common to all the numbers; for the factors not common are the second 2×2 of 16, the 3×3 of 36, and the 5 of 40, and these multiplied by 4 equal 720.

OPERATION.

$$\begin{aligned} 8 &= 2 \times 2 \times 2 \\ 16 &= 2 \times 2 \times 2 \times 2 \\ 36 &= 2 \times 2 \times 3 \times 3 \\ 40 &= 2 \times 2 \times 2 \times 5 \end{aligned}$$

Ans. $2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 = 720$

The same result is more readily obtained by arranging the numbers on a horizontal line, and dividing them by a prime number that will divide the most of them without a remainder. Place the quotients and undivided numbers beneath the horizontal line drawn under the numbers, and divide them by a prime number as in the first instance; put the quotients and undivided numbers as before, beneath the dividends, and continue this process until no prime number will divide any two numbers or quotients. The product of the divisors and the remainders will be the least common multiple.

This method is only another way of rejecting all the factors of the numbers except those whose product is the greatest common divisor, and those not common to all the numbers.

The independent application of the principles of the greatest divisor and least multiple of several numbers will be seen respectively in examples 1 and 2.

OPERATION.

$$\begin{array}{r|llll} 2) & 8, & 16, & 36, & 40 \\ \hline 2) & 4, & 8, & 18, & 20 \\ \hline 2) & 2, & 4, & 9, & 10 \\ \hline & 1, & 2, & 9, & 5 \end{array}$$

Ans. $2 \times 2 \times 2 \times 2 \times 9 \times 5 = 720$.

EXAMPLE 1. — I have three fields: the first 144 feet square, the second 200 feet square, and the third 224 feet square. What is the length of the longest rail that can be used in fencing them, allowing the ends of each rail to touch the ends of the rails next it? Ans. The greatest common divisor of 144, 200, and 224 is 8.

EXAMPLE 2. — What is the size in gallons of the smallest bin whose contents, when filled, can be exactly measured by a 4-gallon measure, a 5-gallon measure, an 8-gallon measure, and a 12-gallon measure? Ans. The least common multiple of 4, 5, 8, and $12 = 120$.

FRACTIONS.

In Arithmetic, *fractions* (from the Latin *frango*, to break) are arrangements of numbers to represent the parts of any whole thing or unit which has been broken or divided into fragments of uniform size.

When the parts represents tenths, hundredths, etc., they are usually written in the form of *decimals*, as heretofore explained.

In all other cases they are expressed as a form of division, with the dividend above and the divisor below the same horizontal line, and are called VULGAR or COMMON FRACTIONS, because more commonly used; thus, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{9}$, etc.

The *dividend* is usually called the *numerator*, and the *divisor* the *denominator*, when thus written.

The DENOMINATOR represents the *fractional units* into which the *unit of the fraction* has been divided; hence it *names* the fractions. Thus, $\frac{1}{7}$ shows that a unit has been divided into seven equal parts, called *sevenths.*

The *unit of a fraction* is the whole thing or unit divided; and each one of the parts resulting from the division is a *fractional unit.*

The NUMERATOR numbers the parts or fractional units used. Thus, the numerator of $\frac{5}{7}$ shows that five of the parts into which the unit is divided are taken for use.

In all operations with common fractions, it should be remembered that the *numerator* represents the *whole number;* and the *denominator*, *the number of parts into which the whole number is divided.* With these two facts constantly in mind, the multiplication and division of fractions will be as simple and the same as the multiplication and division of whole numbers.

When the numerator of a fraction is less than the denominator, the expression has a value less than a unit, hence is really fractional, and therefore is called a PROPER FRACTION. Thus, $\frac{1}{6}$, $\frac{4}{7}$, $\frac{3}{4}$, etc., named *one sixth*, *four sevenths*, *three fourths*, etc.

When the numerator is equal to or larger than the denominator, the value is equal to or more than a unit, hence not properly a fraction, and the expression is called an IMPROPER FRACTION. Thus, $\frac{15}{6}$, $\frac{21}{11}$, etc., named *fifteen sixths*, *twenty-one elevenths*, etc.

When the division indicated in an *improper* fraction has been performed, the result is either a whole number, or a MIXED NUMBER; *i. e.*, a whole number and a fraction. Thus, $6\frac{1}{2}$, $4\frac{5}{6}$, etc. All other fractional expressions are combinations of the above.

A *simple fraction* is a simple expression of division, with a whole number both for the numerator and the denominator; hence it may be either *proper* or *improper.* Thus, $\frac{1}{4}$, $\frac{7}{5}$, etc.

A COMPLEX FRACTION is an expression of division which has a fraction or mixed number for its dividend or divisor or both. Thus

$$\frac{\frac{7}{16}}{\frac{4}{9}},\ \frac{\frac{4}{5}}{2\frac{1}{2}},\ \frac{6\frac{2}{3}}{7\frac{9}{16}},$$ or $\frac{7}{16}$ divided by $\frac{4}{9}$, $\frac{4}{5}$ divided by $2\frac{1}{2}$, $6\frac{2}{3}$ divided by $7\frac{9}{16}$.

A COMPOUND FRACTION is expressed by two or more fractions connected by the word *of*, and is equivalent to the product of the fractions thus connected. Thus, $\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{5}{6} = \frac{2}{3} \times \frac{4}{5} \times \frac{5}{6}$.

The TERMS of a fraction are its numerator and denominator.

REDUCTION OF FRACTIONS is the process of changing their *terms* without changing the value of the fractions.

Since fractions are expressions of division, the numerator and denominator of a fraction may be both multiplied or both divided by the same number without affecting its value.

The multiplication of the numerator or division of the denominator will increase the value of a fraction as many times as there are units in the number used as multiplier or divisor.

The multiplication of the divisor or division of the dividend will decrease the value of a fraction as many times as there are units in the number used as multiplier or divisor.

When the *terms* of a fraction are *prime*, the fraction is said to be in its *lowest terms*.

This is the condition to which a fraction ought always to be brought before operations are performed with it.

To reduce a fraction to its lowest terms, *divide both numerator and denominator by any number that will divide them without a remainder, and so continue dividing until its terms are prime.*

Reduce $\frac{48}{144}$ to its lowest terms.

OPERATION.

$3)\frac{48}{144}=\frac{16}{48} \qquad 4)\frac{16}{48}=\frac{4}{12} \qquad 4)\frac{4}{12}=\frac{1}{3}$

First, dividing both terms by 3, we obtain $\frac{16}{48}$; the terms of $\frac{16}{48}$ divided by $4=\frac{4}{12}$; and the terms of $\frac{4}{12}$ divided by $4=\frac{1}{3}$; *one third* has its terms prime to each other, hence is the lowest form equivalent to $\frac{48}{144}$.

To change an improper fraction to a whole or mixed number, *it is only necessary to perform the division indicated.* Thus, $\frac{48}{8}=6$, because 48 contains 8 six times; or $\frac{29}{7}=4\frac{1}{7}$, because 29 contains 7 four times with a remainder of 1, and as we cannot divide 1 by 7, we indicate the division thus: $\frac{1}{7}$.

To change a whole or mixed number to an improper fraction, *multiply the whole number by the number which is to be the denominator of the fraction, and place the result over that denominator.*

To reduce 5 to a fraction having 9 for a denominator.

OPERATION.

$5\times9=\frac{45}{9}$; or, $5=\frac{5}{1}$; $\frac{5\times9}{1\times9}=\frac{45}{9}$.

Since there are 9 ninths in one unit, there will be 45 ninths in 5 units.

To reduce $4\frac{6}{7}$ to an improper fraction. Since the fractional part of the mixed number is sevenths, the whole number 4 must be reduced to sevenths in order to add the $\frac{6}{7}$ to it; and as there are 7 sevenths in a unit, there will be 4 times 7 or 28 sevenths in 4 units, and 6 added to 28 makes 34 sevenths in $4\frac{6}{7}$.

OPERATION.

$4\frac{6}{7}$
7
—
28
6
—
34 sevenths $=\frac{34}{7}$

To reduce a compound fraction to a simple one, it is only necessary to *place the product of the numerators over the product of the denominators, and reduce the simple fraction thus obtained to its lowest terms.*

Reduce $\frac{4}{5}$ of $\frac{5}{8}$ to a simple fraction.

OPERATION.

$\frac{4}{5}\times\frac{5}{8}=\frac{20}{40}$ or $\frac{1}{2}$

To obtain one fifth of any number, it will of course be necessary to divide the number by 5: but we have previously learned that when we wish to reduce a quotient, we have only to divide the dividend or multiply the divisor; and as the numerator of a fraction represents a dividend, and the denominator a divisor, we can divide the one or multiply the other, and thus divide the fraction. But since we cannot always divide the numerator exactly, we make it a rule to multiply the denominator. Therefore, in the example, we multiply the denominator of $\frac{5}{8}$ by 5 — the denominator of $\frac{4}{5}$ — and obtain as a result $\frac{5}{40}$, which is one fifth of $\frac{5}{8}$. The problem, however, is to obtain four fifths of $\frac{5}{8}$; and as four fifths must be 4 times one fifth, we multiply one fifth of $\frac{5}{8}$, which is $\frac{5}{40}$, by 4; 4 times $\frac{5}{40}$ is $\frac{20}{40}$; and $\frac{20}{40}$ reduced to its lowest terms is $\frac{1}{2}$.

Let the reader take notice that we have treated the numerators as whole numbers and dividends, and the denominators as whole numbers but divisors of the dividends; and we have done this to show that we operate with fractions precisely as with divisors and dividends in division of whole numbers when we wish to increase or decrease the quotient.

The object of this course is to rid the student of the idea, which seems universal, that fractions require a vast amount of labor to be comprehended; when in fact they are merely expressions of unperformed divisions, and are to be operated with as such. In the example we really had 5 to be multiplied by 4, which makes 20; but the 5 was itself to be divided by 8, and the 4 by 5, hence their product should be divided by the product of 8 multiplied by 5, or 40: *i. e.*, $\frac{20}{40}=\frac{1}{2}$. On the same principle a compound fraction of any length can be reduced. Thus, $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}=\frac{2}{3}\times\frac{3}{4}\times\frac{4}{5}\times\frac{5}{6}=\frac{120}{360}=\frac{1}{3}$.

ADDITION AND SUBTRACTION OF FRACTIONS.

Fractions have a common denominator when their denominators are alike; *i. e.*, they are of the same order, because their fractional units are divided into the same number of parts: hence they can be added or subtracted as units of the same order. Thus, $\frac{5}{7}+\frac{1}{7}=\frac{6}{7}$; and $\frac{5}{7}-\frac{1}{7}=\frac{4}{7}$.

To reduce fractions to a least common denominator, it is necessary *to take, for the denominator of each fraction, the least common multiple of all the denominators of the fractions, and increase the numerator of each fraction as many times as its denominator has been increased in the common denominator;* which is in accordance with the principle that the quotient or the value of a fraction is not changed by multiplying or dividing both its terms by the same number.

Reduce $\frac{5}{6}$, $\frac{7}{8}$, and $\frac{11}{12}$ to equivalent fractions having a least common denominator.

The least common multiple of 6, 8, and 12 is 24. Since 24 is the least denominator which these fractions have in common, the division of 24 by each denominator will give the number of times that denominator has been increased; and in order that the fraction with the new denominator may be equivalent to the original, we increase the original numerator the same number of times. 24 divided by 6 equals 4, and 4 times 5 makes 20, hence $\frac{20}{24}$ is the equivalent of $\frac{5}{6}$; 24 divided by $8=3$, and 3 times 7 makes 21, hence $\frac{21}{24}$ is the equivalent of $\frac{7}{8}$; 24 divided by $12=2$, and 2 times $11=22$, hence $\frac{22}{24}$ is the equivalent of $\frac{11}{12}$.

OPERATION.

$$6)\underline{24} \quad 8)\underline{24} \quad 12)\underline{24}$$
$$4 \qquad\quad 3 \qquad\quad 2$$

$$\frac{5\times4}{6\times4}=\frac{20}{24},\quad \frac{7\times3}{8\times3}=\frac{21}{24},\quad \frac{11\times2}{12\times2}=\frac{22}{24}$$

$$\frac{5}{6}=\frac{20}{24},\quad \frac{7}{8}=\frac{21}{24},\quad \frac{11}{12}=\frac{22}{24}.$$

When fractions have a common denominator, they can be added or subtracted by simply placing the sum or difference of their numerators over the common denominator. When they have not a common denominator, they must be reduced as above before they can be added or subtracted.

When a mixed number is to be added to or subtracted from a mixed number, the fractional part should be added or subtracted first, and then the whole numbers.

Thus,

Subtract $16\frac{7}{8}$ from $112\frac{4}{7}$.

We cannot subtract the fractional parts until they are reduced to the same denomination; and as the denominators are prime to each other, the least common multiple of their denominators will be their product, 56. $\frac{7}{8}=\frac{49}{56}$, and $\frac{4}{7}=\frac{32}{56}$; but we cannot take 49 from 32, hence we have to reduce one unit to fifty-sixths and add it to 32, making $\frac{88}{56}$ $(\frac{56}{56}+\frac{32}{56})$; $\frac{49}{56}$ from $\frac{88}{56}$ leaves $\frac{39}{56}$, which we place as a part of the difference. As we have used one unit, there will be but one unit from which to take 6; but one unit of the next order equals ten of this, and $10+1=11$; 6 from $11=5$, which we place under its column. We complete the subtraction as in whole numbers.

OPERATION.

$$\begin{array}{r} 112\frac{4}{7} \\ 16\frac{7}{8} \\ \hline 95\frac{39}{56} \end{array}$$

If we had desired to add the above numbers, we should have proceeded in the same way to reduce the fractions to fifty-sixths, and then added the numerators: $\frac{49}{56}+\frac{32}{56}=\frac{81}{56}=1\frac{25}{56}$. We reduce the improper fraction $\frac{81}{56}$ to a mixed number, put the fractional part beneath the line as a part of the amount, and add the 1 to its order, and continue as in whole numbers.

OPERATION.

$$\begin{array}{r} 112\frac{4}{7} \\ 16\frac{7}{8} \\ \hline 129\frac{25}{56} \end{array}$$

OPERATION.

$$56-12\frac{3}{4}=43\frac{1}{4} \qquad \begin{array}{r} 56 \\ 12\frac{3}{4} \\ \hline 43\frac{1}{4} \end{array}$$

The process of subtraction of a mixed number from a whole number is precisely as above in principle; one unit having to be reduced to the denomination of the fraction in order to take the fraction from it.

MULTIPLICATION OF FRACTIONS.

To multiply a whole number by a fraction, it is only necessary to *multiply by the numerator and divide the product by the denominator;* thus, $5\times\frac{6}{7}=\frac{30}{7}=4\frac{2}{7}$. The effect is the same as multiplying the fraction by the whole number, though the reasoning is reversed. In the first case the whole number is divided by 7, the denominator, to obtain one seventh of that number, and the result is multiplied by 6 to obtain six sevenths of that number; in the second case, we simply say that 5 times $\frac{6}{7}$ or six sevenths $=\frac{30}{7}$ or thirty sevenths.

The multiplication of a whole number by a mixed number is the same as above, only the products by the fractional part and whole part of the mixed number are added.

$$\begin{array}{r} 25 \\ 3\frac{1}{5} \\ \hline 75 \\ 20 \\ \hline 95 \end{array}$$

OPERATION.

$$\begin{array}{lr} \text{Product by 3 is } 25\times 3 = & 75 \\ \text{Product by } \frac{1}{5} \text{ is } 25\times\frac{1}{5} = & 20 \\ \hline & 95 \end{array}$$

To multiply a mixed number by a mixed number. *The mixed numbers may be reduced to improper fractions, and then the product of the numerators placed over the product of the denominators; or the whole and fractional parts may be multiplied separately and the partial products united.*

Multiply $25\frac{3}{4}$ by $20\frac{2}{3}$.

OPERATION.
First Method.

$$25\tfrac{3}{4} = \tfrac{103}{4};\quad 20\tfrac{2}{3} = \tfrac{62}{3}$$

$$\tfrac{103}{4} \times \tfrac{62}{3} = \tfrac{6386}{12} = 532\tfrac{1}{6}$$

OPERATION.
Second Method.

$$\begin{array}{r} 25\frac{3}{4} \\ 20\frac{2}{3} \\ \hline 500 \\ 15 \\ 16\frac{2}{3} \\ \frac{6}{12} \\ \hline 532\frac{1}{6} \end{array}$$

ANALYSIS OF OPERATION.

$$\begin{array}{rcl} 25 \times 20 & = & 500 \\ \frac{3}{4} \times 20 & = & 15 \\ 25 \times \frac{2}{3} & = & 16\frac{2}{3} \\ \frac{3}{4} \times \frac{2}{3} & = & \frac{6}{12} \\ \hline & & 532\frac{1}{6} \end{array}$$

The process of multiplying one fraction by another has already been explained in reducing a compound fraction to a simple one.

DIVISION OF FRACTIONS.

Division of fractions is the process of dividing when either the divisor or the dividend is itself an expression of division, or when both are expressions of division.

To divide a fraction by a whole number, it is necessary only to consider the numerator a dividend and the denominator a divisor, and proceed as in whole numbers; that is, *either divide the dividend or multiply the divisor.*

Divide $\frac{21}{22}$ by 3.

FIRST OPERATION.

$$\tfrac{21}{22} \div 3 = \tfrac{7}{22}, \text{ or } \tfrac{21}{3} \div 22 = 7 \div 22 = \tfrac{7}{22}.$$

SECOND OPERATION.

$$\tfrac{21}{22} \div 3 = \tfrac{21}{22 \times 3} = \tfrac{21}{66} = \tfrac{7}{22}.$$

To divide one fraction by another, it is only necessary to *invert the divisor, and proceed as in multiplication*, because division is the exact opposite of multiplication.

Divide $\frac{9}{8}$ by $\frac{3}{4}$.

FIRST OPERATION.

Dividend.

$$\text{Divisor.}\quad \begin{matrix} 3) \\ 4) \end{matrix}\ \ \frac{9}{8}\ \ \begin{matrix} (3 \\ (2 \end{matrix}\quad \text{Quotient.}$$

Divisor. Quotient. Dividend.

Proof, $\frac{3}{4} \times \frac{3}{2} = \frac{9}{8}$

If we consider $\frac{9}{8}$ and $\frac{3}{4}$ only expressions for division, we may proceed as with whole numbers; and as 9 and 3 represent dividends, and 8 and 4 represent divisors, we may divide one dividend by the other, and the corresponding divisor by the other divisor, as though we were simply dividing one whole number by another. The quotient resulting from the latter division will be the proper divisor of the quotient resulting from the division of the dividends. In the example, the first operation explains itself, and is the simplest possible. The fractions are arranged for division as whole numbers, and the division is performed as though the numerators and denominators were independent.

SECOND OPERATION.

Dividend. Divisor. Inverted Divisor.

$$\tfrac{9}{8} \div \tfrac{3}{4} = \tfrac{9}{8} \times \tfrac{4}{3}$$

Dividend. Inverted Divisor.

$$\tfrac{9}{8} \times \tfrac{4}{3} = \tfrac{36}{24} = \tfrac{3}{2} \quad \text{Quotient.}$$

Divisor. Quotient. Dividend.

Proof, $\frac{3}{4} \times \frac{3}{2} = \frac{9}{8}$

When the terms of one fraction are not exactly divisible by the corresponding terms of the other, the above process would not be so convenient, because the quotients resulting would be mixed numbers; hence we use multiplication to effect our purpose, on the general principles that multiplying a divisor is the same as dividing a dividend, and multiplying a dividend is the same as dividing a divisor. In the example, considering for the moment that 9 cannot be exactly divided by three, we effect the purpose by multiplying 8, the divisor of 9, by

3, the result being $\frac{9}{24}$. We, however, were not dividing $\frac{9}{8}$ by 3 units but by $\frac{1}{4}$ of 3; hence in $\frac{9}{24}$, $\frac{9}{8}$ has been made four times smaller than it ought, and the correct quotient may be obtained by multiplying $\frac{9}{24}$ by 4, making $\frac{36}{24}$ or $\frac{3}{2}$. By examination of the analysis, it will be seen that the numerator of $\frac{9}{8}$ has been multiplied by the denominator of $\frac{3}{4}$, and the denominator of $\frac{9}{8}$ has been multiplied by the numerator of $\frac{3}{4}$, which is the same as inverting the divisor and proceeding as in multiplication. This process is virtually, and the result actually, the same as the first.

To divide a mixed number by a whole number.

The mixed number may be reduced to an improper fraction, and the division then performed as heretofore directed; or the whole part and fractional part may be divided separately, and the quotients united.

Divide $125\frac{4}{5}$ by 6.

FIRST OPERATION.

$$125\tfrac{4}{5}=\tfrac{629}{5}\div 6=\tfrac{629}{30}=20\tfrac{29}{30}$$

SECOND OPERATION.

$$\begin{array}{l} 6)\;125\tfrac{4}{5}\;(20+\tfrac{29}{30}=20\tfrac{29}{30} \\ \quad\;\underline{12} \\ \qquad 5\tfrac{4}{5}=\tfrac{29}{5}\div 6=\tfrac{29}{30} \end{array}$$

To divide a mixed number by a mixed number, or to reduce a complex fraction to a simple one.

Reduce the mixed numbers to improper fractions, and proceed as in division of fractions; that is, invert the divisor and proceed as in multiplication.

Divide $6\frac{7}{8}$ by $3\frac{2}{3}$; or, reduce $\frac{6\frac{7}{8}}{3\frac{2}{3}}$ to a simple fraction.

$$\frac{6\frac{7}{8}=\frac{55}{8}}{3\frac{2}{3}=\frac{11}{3}};\quad \tfrac{55}{8}\times\tfrac{3}{11}=\tfrac{165}{88}=1\tfrac{77}{88}=1\tfrac{7}{8}.$$

These operations with fractions may sometimes be shortened by casting out factors common to divisor and dividend. This process is called CANCELLATION.

For instance, if we have several fractions to be multiplied together, as $\frac{4}{5}\times\frac{5}{6}\times\frac{6}{7}\times\frac{7}{8}\times\frac{8}{9}$, which would make a large fraction, requiring reduction if the indicated multiplications were all performed, we may strike out factors common to dividend and divisor, and only multiply together the remaining factors.

In the ordinary way, $\frac{4}{5}\times\frac{5}{6}\times\frac{6}{7}\times\frac{7}{8}\times\frac{8}{9}$ would equal $\frac{6720}{15120}$, which would need reducing to its lowest terms, $\frac{4}{9}$.

OPERATION BY CANCELLATION.

Dividing by factors which we see at a glance are common to both numerator and denominator, we first use 5, and find it contained in the numerator of $\frac{5}{6}$ one time, and in the denominator of $\frac{4}{5}$ one time; hence we write 1 in place of 5, in each case. We do the same with 6, and with 7, and 8. We now multiply together the quotients and unchanged numerators and the quotients and unchanged denominator, and have $\frac{4}{9}$ for our result as in the first case.

$$\frac{4\times\cancel{5}\times\cancel{6}\times\cancel{7}\times\cancel{8}}{\cancel{5}\times\cancel{6}\times\cancel{7}\times\cancel{8}\times 9}=\frac{4}{9}$$

$$\frac{4\times 1\times 1\times 1\times 1}{1\times 1\times 1\times 1\times 9}=\frac{4}{9}$$

COMPOUND NUMBERS.

A COMPOUND NUMBER is a number consisting of two or more denominations of the same kind of concrete units; as, 3 rods, 10 feet, 11 inches; 4 pounds, 6 shillings, 7 pence.

In *simple* numbers the scale of increase is uniform, each order or denomination being tenfold the value of the next order toward the right; but in *compound* numbers the scale varies, requiring a different number of units in different cases to make one of the next higher order; as, for instance, in measures of length, 12 inches make one foot, 3 feet make one yard, $5\frac{1}{2}$ yards make one rod, etc.

REDUCTION OF COMPOUND NUMBERS is the process of finding equivalent values for numbers of one or more orders or denominations of a certain kind, in other orders or denominations of the same kind; as, the number of *rods* in a certain number of *feet* and *inches*, or *vice versa.*

The process of changing higher orders to equivalents in lower orders is called REDUCTION DESCENDING, and is performed by *multiplication*, using the scale of multipliers indicated in the proper table.

The process of changing lower orders to equivalents of higher orders is called REDUCTION ASCENDING, and is performed by *division*, using the proper scale of divisors.

The *principle* involved is precisely as in simple numbers; the only difference is the varying scale of increase and decrease in compound numbers, while it is uniformly 10 in simple numbers.

The method is the same in all cases of compound numbers; the only difference being in the scale of equivalents, as shown in the tables which follow: —

As a sample of the two processes, let us take a compound number of length, using the scale of the table of LONG MEASURE.

EXAMPLE 1. — In 1 m. 40 rd. 12 ft. 3 in., how many inches?

In the table we find 320 rods make 1 mile; hence we use it for the first multiplier. Multiplying 1 by 320, and adding 40, we obtain 360, the number of rods in 1 mile and 40 rods. The next lower order in the example is feet, and we find in the table that $16\frac{1}{2}$ feet make 1 rod; hence we multiply 360 by $16\frac{1}{2}$, and add 12 to obtain the number of feet in 360 rods and 12 feet, and the result is 5952 feet. We see by the table that 12 inches make 1 foot; hence we multiply the number of feet, 5952, by 12, and add 3 to obtain 71427, the number of inches in 5952 feet and 3 inches, or the number of inches in 1 m. 40 rd. 12 ft. 3 in.

OPERATION.

```
 1 m. 40 rd. 12 ft. 3 in.
  320
 ————
  320
   40
 ————
  360
  16½
 —————
 2160
 360
  180
   12
 —————
 5952
   12
 —————
 11904
 5952
     3
 —————
 71427 in.   Ans.
```

EXAMPLE 2. — Find the number of miles, rods, feet, and inches in 71427 inches.

OPERATION.

```
     12) 71427 in.
         ————————
   16.5) 5952 ft. 3 in.
         ——————————————
    320) 360 rd. 12 ft.
         ——————————————
         1 m. 40 rd.
Ans. 1 m. 40 rd. 12 ft. 3 in.
```

We first divide the whole number of inches — 71427 — by 12, to find the number of feet in that number of inches, and the result is 5952 feet and a remainder of 3 inches.

To find the number of rods in 5952 feet, we divide by the number of feet in 1 rod, $16\frac{1}{2}$ or 16.5, and find 360 rods and a remainder of 12 feet. We then divide the 360 rods by 320, — the number of rods in 1 mile, and obtain 1 mile and a remainder of 40 rods, as the result of the last division. We find, therefore, that in 71427 inches there is 1 mile, 40 rods, 12 feet, and 3 inches.

From these analyses we obtain the following rules for general application to reduction of compound numbers:—

REDUCTION DESCENDING. — RULE. Multiply the highest denomination given by the number of the next lower given order required to make one of the order multiplied, and to the product add the number of units of the same order in the multiplicand. Multiply this sum by the number of the next lower given order required to make one of this order, and add the number of the corresponding order in the multiplicand. Continue this process till the reduction is brought to the order required.

REDUCTION ASCENDING. — RULE. Divide the given number by the number of units of that order it takes to make one of the next higher order required; if there be a remainder, it will be a part of the answer, and of the same order as the dividend from which it came. Divide the quotient thus obtained by the number of units of that order it takes to make one of the next higher order required; and so proceed until the highest required denomination has been reached. The last quotient and the several remainders will be the answer sought.

NOTE. — These rules apply as well to fractions as to whole numbers.

To reduce a fraction of a compound number from a higher to a lower denomination.

What part of a pint is $\frac{3}{320}$ of a bushel?

OPERATION.

$\frac{3}{320} \times 4 = \frac{12}{320}$ pk.; $\frac{12}{320} \times 8 = \frac{96}{320}$ qt.; $\frac{96}{320} \times 2 = \frac{192}{320} = \frac{3}{5}$ pt. Ans.

To reduce a fraction of a compound number from a lower to a higher denomination.

What part of a bushel is $\frac{3}{5}$ of a pint?

OPERATION.

$\frac{3}{5} \times 2 = \frac{3}{10}$ qt.; $\frac{3}{10} \times 8 = \frac{3}{80}$ pk.; $\frac{3}{80} \times 4 = \frac{3}{320}$ bu. Ans.

It will be seen that the processes in these cases are exactly opposite, the first being performed by *multiplication*, and the second by *division*, or its equivalent the multiplication of the denominator of the fraction, — exactly the same in principle as in whole numbers.

The processes are the same in principle when the fraction is a decimal or when a decimal is to be obtained.

Reduce 1 pint to the decimal of a bushel.	Reduce .015625 of a bushel to pints.
OPERATION.	
2) 1.0 pt.	.015625 bush.
8) .5000 qt.	4
4) .062500 pk.	.062500 pk.
.015625 bu.	8
	.500000 qt.
	2
	1.000000 pt.

In the addition, subtraction, multiplication, and division of compound numbers, the processes are precisely the same as the corresponding processes with simple numbers, only the scale of divisors and multipliers used in determining the number of units of one order or denomination that may be in another is the same as in reduction of compound numbers, instead of ten as in simple numbers.

A single example of each is here given.

Find the amount of 37 bu. 3 pk. 5 qt. 1 pt.; 61 bu. 2 pk. 7 qt. 1 pt.; 32 bu. 3 pk. 2 qt.; 71 bu. 1 pk. 6 qt. 1 pt.; 61 bu. 1 pk. 3 qt. 1 pt.; and 32 bu. 3 pk. 3 qt. 1 pt.

OPERATION OF ADDITION.

bu.	pk.	qt.	pt.
37	3	5	1
61	2	7	1
32	3	2	
71	1	6	1
61	1	3	1
32	3	3	1
298	0	4	1

OPERATION OF SUBTRACTION.

lb.	oz.	pwt.	gr.
71	3	12	15
16	10	17	20
54	4	14	19

OPERATION OF MULTIPLICATION.

£	s.	d.	far
1	8	7	2
			7
10	0	4	2

OPERATION OF DIVISION.

	A.	R.	p.	yd.	ft.	in.
11)	144	3	18	3	1	36
	13	0	27	3	0	$45\frac{9}{11}$

WEIGHTS AND MEASURES.

COMMON MEASURE OF LENGTH.

TABLE.

12 inches	1 foot.
3 feet	1 yard.
5½ yards or 16½ feet	1 rod or pole.
40 rods	1 furlong.
8 furlongs or 320 rods	1 mile.
60 geographical, or 69⅙ (nearly) statute, miles	1 degree on the equator.
360 degrees	1 great circle or the earth's circumference.

EQUIVALENTS.

mi.		fur.		rd.		yd.		ft.		in.
1	=	8	=	320	=	1760.	=	5280	=	63360
		1	=	40	=	220	=	660	=	7920
				1	=	5½	=	16½	=	198
						1	=	3	=	36
								1	=	12

SCALE OF UNITS: 12, 3, 5½, 40, 8.

NOTE 1. — The degrees of longitude vary in length under different parallels of latitude. At 25 degrees of latitude the length of a degree of longitude is 62.7 miles; at 40° of latitude, it is 53 miles; at 42° of latitude, it is 51½ miles; and at 60° of latitude, it is 34.58 miles.

NOTE 2. — The geographical or nautical mile is 795 4-5 feet longer than the common mile, and is adopted by mariners for convenience, since one mile corresponds to one minute of arc.

MARINER'S MEASURE OF LENGTH.

Table used by mariners in calculating distances on water, and the speed of vessels.

9 in.	1 span.
8 spans, or 6 feet	1 fathom.
120 fathoms	1 cable's length
7⅓ cables	1 mile or knot.
3 miles	1 league.

Note. — The number of knots of the log-line run off in half a minute indicates the number of knots of distance a vessel goes per hour. A log-line one mile in length would contain 120 knots.

SURVEYOR'S MEASURE OF LENGTH

Is used for measuring boundaries of land, roads, areas, railroads, and canals.

The UNIT OF MEASURE is one Gunter's chain, or 66 feet.

Table.

7 92-100 inches	1 link.
25 links	1 rod.
4 rods, or 100 links	1 chain.
80 chains	1 mile.
10 chains long by 1 broad, or 10 sq. chains	1 acre.

Equivalents.

mi.	ch.	rd.	l.	in.
1 =	80 =	320 =	8000 =	63360
	1 =	4 =	100 =	792
		1 =	25 =	198
			1 =	7.92

Scale of Units: 7.92, 25, 4, 80.

Measurements are recorded in chains and hundredths. Latterly a steel measuring tape 100 feet long, with each foot divided into tenths, is used by engineers as a substitute for the cumbersome chain.

Note. — By scientific persons and revenue officers, the inch is divided into *tenths*, *hundredths*, etc. Among mechanics, the inch is divided into *eighths*.

A standard English mile, which is the measure that we use, is 5,280 feet in length, 1,760 yards, or 320 rods. A strip one rod wide and one mile long is two acres. By this it is easy to calculate the quantity of land taken up by roads, and also how much is wasted by fences.

COMMON SURFACE OR SQUARE MEASURE.

It is used in measuring surfaces, as land, boards, etc.

Table.

144 square inches	1 sq. foot.
9 square feet	1 sq yard.
30¼ square yards	1 sq. rod.
40 square rods	1 rood.
4 roods, or 160 square rods	1 acre.
640 acres	1 sq. mile.

Scale of Units: 144, 9, 30¼, 40, 4, 640.

Equivalents.

sq.m.	A.	R.	sq. rd.	sq. yd.	sq. ft.	sq. in.
1 =	640 =	2560 =	102400 =	3097600 =	27878400 =	4014489600
	1 =	4 =	160 =	4840 =	43560 =	6272640
		1 =	40 =	1210 =	10890 =	1568160
			1 =	30¼ =	272¼ =	39204
				1 =	9 =	1596
					1 =	144

Note 1. — An acre equals a square piece of land measuring 209 feet on each side.

The English acre contains 4,840 square yards; the Scotch, 6,150; the Irish, 7,840; the Amsterdam, 9,722; Prussia (*morgen*), 3,053; France (*hectare*), 11,960.

The United States measure is the same as the English.

The products of different countries must be compared by the acreage as above indicated.

Glazing, stone-cutting, etc., are estimated by the square foot. Plastering, flooring, paving, etc., are estimated by the square yard.

Note 2. — In square measure as used by *surveyors*, 625 square links = 1 square rod, 16 square rods = 1 square chain, 10 square chains = 1 acre, 640 acres = 1 square mile, and 36 square miles or 6 miles square = one township.

CUBIC OR SOLID MEASURE.

It is used in measuring bodies, or determining quantity of solids, capacity of definite portions of space, etc. The cubic contents of anything equals the product of its length, breadth, and thickness.

TABLE.

1728 cubic inches	1 cubic foot.
27 cubic feet	1 cubic yard.
40 cubic feet	1 ton.
16 cubic feet	1 cord foot.
8 cord feet, or 128 cubic feet	1 cord of wood.
24¾ cubic feet	1 perch.

EQUIVALENTS.

C.		T.		cu. yd.		cu. ft.		cu. in.
1	=	$3\frac{1}{5}$	=	$4\frac{20}{27}$	=	128	=	221184
		1	=	$1\frac{13}{27}$	=	40	=	69120
				1	=	27	=	46656
						1	=	1728

NOTE. — A registered ton, in computing the tonnage of ships and vessels, is 100 cubic feet of internal capacity.

In measuring cargoes, a ton is 40 cubic feet in the United States, and 42 cubic feet in England.

Light articles of freight are generally estimated by the space occupied, but heavy articles by weight.

A cubic yard of earth is called a *load*.

Bricks are of various dimensions. The average size is 8 inches long, 4 inches wide, 2 inches thick. 27 bricks make a cubic foot, when laid dry; laid in mortar, ⅛ to $\frac{1}{10}$ is allowed for mortar. Baltimore and Milwaukee bricks are 8¼ × 4⅛ × 2⅝ inches.

Brickwork is generally estimated by the 1,000. When measured by square measure the work is understood to be 12 inches thick.

Board and Lumber Measure. — All estimates are made on one inch in thickness; for every ¼ inch in thickness, ¼ price is added.

Board feet are changed to cubic feet by dividing by 12; *cubic feet* to board by multiplying by 12.

In material only is allowance made for windows, doors, and cornices, no allowance being made in estimating the work. The size of a cellar or wall is estimated by the measurement of the outside. No allowance for corners.

A cord of wood is a pile 8 feet long by 4 feet wide and 4 feet high.

A cord foot is 1 foot of the running pile, or ⅛ of a cord.

A pile of wood 4 feet high, 4 feet wide, and 1 foot thick is 1 cord foot.

A perch of stone or masonry is 16½ feet long, 1½ feet wide, and 1 foot high.

Wood. — Measuring wood in the load: if the rack is narrower at the bottom than at the top, the width of the load should be measured half-way from base to top. This will give the average width.

AVOIRDUPOIS WEIGHT

Is the standard weight for weighing the greater portion of articles used in trade and commerce, such as groceries, produce, iron, coal, hay, cotton, etc.

The UNIT OF MEASURE is one pound, containing 7000 grains.

TABLE.

437½ grains (*gr.*)	1 ounce,	*oz.*
16 ounces	1 pound,	*lb.*
25 pounds	1 quarter,	*qr.*
4 quarters	1 hundredweight,	*cwt.*
20 hundredweight	1 ton,	*T.*

SCALE OF UNITS: 437½, 16, 25, 4, 20.

EQUIVALENTS.

T.		cwt.		qr.		lb.		oz.		gr.
1	=	20	=	80	=	2000	=	32000	=	14000000
		1	=	4	=	100	=	1600	=	700000
				1	=	25	=	400	=	175000
						1	=	16	=	7000
								1	=	437½

The *dram* is now seldom used, except with silk manufacturers. The ounce is divided into quarters and halves.

The following denominations are also used: —

TABLE.

English Avoirdupois Weight.

16 drams	1 ounce.
16 ounces	1 pound.
28 pounds	1 quarter.
4 quarters or 112 pounds	1 hundredweight.
20 hundredw't or 2240 pounds	1 ton (long ton).

EQUIVALENTS.

T.		cwt.		qr.		lb.		oz.
1	=	20	=	80	—	2240	=	35840
		1	=	4	=	112	=	1792
				1	=	28	=	448
						1	=	16

This measure is nearly obsolete. It is allowed at the custom-house in estimating duties, and in wholesale transactions of iron and coal.

Note. — The grain Avoirdupois, though never used, is the same as the grain in Troy Weight. 7000 grains make the Avoirdupois pound, and 5760 grains the Troy pound.

MISCELLANOUS TABLE.

100 pounds of grain or flour	1 cental.	100 pounds of nails	1 keg.
100 " " raisins	1 cask.	196 " " flour	1 barrel.
100 " " dry fish	1 quintal.	200 " " pork, beef, etc.	1 barrel.

TROY WEIGHT

Is used for weighing gold, silver, platinum, and precious stones, except diamonds; also in philosophical experiments.

The Unit of Measure is one pound, containing 5760 grains.

TABLE.

24 grains (*gr.*)	1 pennyweight,	*pwt.*
20 pennyweights	1 ounce,	*oz.*
12 ounces	1 pound,	*lb.*

Scale of Units: 24, 20, 12.

EQUIVALENTS.

lb.		oz.		pwt.		gr.
1	=	12	=	240	=	5760
		1	=	20	=	480
				1	=	24

The Troy pound is the standard of weight at the United States Mint, and contains 5670 grains to the pound, or 1240 grains less than the Avoirdupois pound. In mixing medicines not liquid, apothecaries use Troy grains.

RELATIVE VALUE OF AVOIRDUPOIS, TROY, AND APOTHECARIES' WEIGHTS.

(For Apothecaries' Weight see "Medicine.")

7000 grains	1 lb. Avoirdupois.	437½ grains	1 ounce Avoirdupois.
5760 "	1 " Troy or Apothecaries'.	480 "	1 " Troy or Apothecaries'.
100 Avoirdupois	121$\frac{19}{36}$ lbs. Troy.		

LIQUID OR WINE MEASURE

Is used in measuring liquids, such as liquors, vinegar, molasses, oils, etc., and in estimating the capacity of vessels designed to contain them.

The Unit of Measure is the gallon.

TABLE.

4 gills (*gi.*)	1 pint,	*pt.*
2 pints	1 quart,	*qt.*
4 quarts	1 gallon,	*gal.*
31½ gallons	1 barrel,	*bbl.*
2 barrels	1 hogshead,	*hhd.*
2 hogsheads	1 pipe or butt,	*pi.*
2 pipes	1 tun.	

SCALE OF UNITS: 4, 2, 4, 31½, 2, 2, 2.

EQUIVALENTS.

T.	pi.	hhd.	bbl.	gal.	qt.	pt.	gi.
1 =	2 =	4 =	8 =	252 =	1008 =	2016 =	8064
	1 =	2 =	4 =	126 =	504 =	1008 =	4032
		1 =	2 =	63 =	252 =	504 =	2016
			1 =	31½ =	126 =	252 =	1008
				1 =	4 =	8 =	32
					1 =	2 =	8
						1 =	4

36 gallons make	1 barrel of ale, beer, or milk.
54 " "	1 hogshead " " "
42 " "	1 tierce.
2 tierces "	1 puncheon.

NOTE.—In Massachusetts 32 gallons make one *barrel*, and in some other States the barrel varies from 28 to 32 gallons.

DRY MEASURE

Is used in measuring articles not fluid, such as grain, seeds, fruit, vegetables, salt, ashes, lime, etc.

The *unit of measure* is the Winchester bushel.

TABLE.

2 pints (*pt.*)	1 quart,	*qt.*
8 quarts	1 peck,	*pk.*
4 pecks	1 bushel,	*bu.*
36 bushels	1 chaldron,	*ch.*

SCALE OF UNITS: 2, 8, 4, 36.

EQUIVALENTS.

ch.	bu.	pk.	qt.	pt.
1 =	36 =	144 =	1152 =	2304
	1 =	4 =	32 =	64
		1 =	8 =	16
			1 =	2

The legal bushel of the United States is the old Winchester measure, cylindrical in form, 18½ inches in diameter and 8 inches deep, containing $2150\frac{42}{100}$ cubic inches. The Imperial bushel of England is $2218\frac{192}{1000}$ cubic inches. Thirty-two English bushels equal 33 of the United States.

Heaped measure is the contents of bushels heaped in the shape of a cone. Corn in the ear, large fruits, vegetables, and bulky articles are sold by this measure.

In measuring bituminous coal, lime, large fruits, and vegetables, the measure is heaped, and should contain $\frac{5}{4}$ or 125% of 2150.42 cubic inches, or 2688.025 cubic inches.

Stricken measure is the bushel even full, having been stricken off by a rule or striker. Grain, seeds, etc., are sold by this measure. It is customary to allow five stricken measures for four heaped ones. It is usual to quote the price of grain, etc., by the bushel, but more frequently to determine their value by weight.

One pint dry measure equals $1\frac{1}{6}$ pints (nearly) liquid measure.

A bushel of corn in the ear is three heaped half-bushels, or four even full.

In Pennsylvania 80 lbs. coarse, 70 lbs. ground, or 62 lbs. fine salt make one bushel; and in Illinois 50 lbs. common or 55 lbs. fine salt make one bushel. In Tennessee 100 ears of corn make a bushel. A heaping bushel contains 2815 cubic inches.

A cask of lime is 240 lbs. Lime in slacking absorbs 2½ times its volume and 2¼ times its weight of water.

RELATIVE VALUE OF LIQUID, DRY, AND BEER MEASURES.

231 cubic inches	1 gallon liquid measure.
268⅘ cubic inches	1 gallon dry measure.
282 cubic inches	1 gallon beer measure.
57¾ cubic inches	1 quart liquid measure.
67⅕ cubic inches	1 quart dry measure.
70½ cubic inches	1 quart beer measure.

1 gallon beer measure = $1\frac{17}{77}$ gallons liquid measure = $1\frac{11}{224}$ dry measure. Beer measure is nearly obsolete. 8 gallons equal 1 bushel dry measure.

Paper Measure.

24 sheets	1 quire.
20 quires	1 ream.
2 reams	1 bundle.
10 reams	1 bale.

Quantities by Number.

12 articles	1 dozen.
13 articles	1 long or baker's dozen.
20 articles	1 score.
12 dozen	1 gross.
12 gross or 144 dozen	1 great gross.

SIZE OF NAILS.

2-penny	— 1 inch	557	nails per pound.
4-penny	— 1¼ inches	353	" "
5-penny	— 1¾ "	232	" "
6-penny	— 2 "	167	" "
7-penny	— 2¼ "	141	" "
8-penny	— 2½ "	101	" "
10-penny	— 2¾ "	68	" "
12-penny	— 3 inches	54	nails per pound.
20-penny	— 3½ "	34	" "
Spikes	— 4 "	16	" "
Spikes	— 4½ "	12	" "
Spikes	— 5 "	10	" "

From this table an estimate of quantity and suitable sizes for any job of work can be made.

TIME.

Time is the standard measure of duration.

The *unit of measure* may be seconds, minutes, hours, days, weeks, months, years, decades, or centuries.

TABLE.

60 seconds	1 minute.
60 minutes	1 hour.
24 hours	1 day.
7 days	1 week.
28 days	1 lunar month.
28, 29, 30, or 31 days	1 cal. month.
12 calendar months	1 year.
365 days*	1 com. year.
366 days*	1 leap year.*
365¼ days	1 Julian year.
365d. 5h. 48m. 49s	1 solar year.
365d. 6h. 9m. 12s	1 sidereal year.
10 years	1 decade.
10 decades, or 100 years	1 century.

Equivalents.

yr.		da.		hr.		min.		sec.
1	=	365¼	=	8766	=	525960	=	31557600
		1	=	24	=	1440	=	86400
				1	=	60	=	3600
						1	=	60

Scale of Units: 60, 60, 24, 365¼.

In business transactions 30 days are considered 1 month. The civil day begins and ends at 12 o'clock midnight.

In dating events, astronomers calculate the day as beginning and ending at 12 o'clock noon.

* Note. — The common year thus consists of 365 days. Once in 4 years, however, one day is added to February, making 366 days; and thus each year averages 365¼ days. The longest year is called Bissextile, or Leap year. Centuries divisible by 400, and other years divisible by 4, are leap years.

The centuries and years *before* the birth of Christ are designated as B. C., and those *since* as A. D.

The calendar months with their lengths are as follows: —

January,	31 days.	April,	30 days.	July,	31 days.	October,	31 days.
February,	28 days.	May,	31 days.	August,	31 days.	November,	30 days.
March,	31 days.	June,	30 days.	September,	30 days.	December,	31 days.

CIRCULAR MEASURE, OR DIVISION OF THE CIRCLE.

Used in Astronomy, Geography, Navigation, and Surveying; also for measuring angles, arcs of circles, and for calculating the difference of time.

The *unit of measure* is the degree.

TABLE.

60 seconds (″) ....1 minute.—′
60 minutes........................1 degree. — °
30 degrees........................1 sign. — *S.*
12 *S.*, or 360°....................1 circle. — *C.*
90° equal 1 quadrant or right angle.

The greatest distance across a circle is called its *diameter.* The distance around it is called its *circumference.* Any part of the circumference is called an *arc.* A line extending from the centre to the circumference is called the *radius.* The surface included within any given lines is called the *area.*

For further notice of time see "Astronomy."

EQUIVALENTS.

C.		*S.*		°		′		″
1	=	12	=	360	=	21600	=	1296000
		1	=	30	=	1800	=	108000
				1		60	=	3600
						1	=	60

SCALE OF UNITS: 60, 60, 30, 12.

A semi-circumference is $\frac{1}{2}$ of a circle, 180°.
A quadrant is $\frac{1}{4}$ of a circle, 90°.
A sextant is $\frac{1}{6}$ of a circle, 60°.

LONGITUDE AND TIME.

The turning of the earth on its axis from west to east causes the sun to appear to move about the earth from east to west, from the meridian of any place to the same meridian again, or 360°, in 24 hours; hence its change of position relatively to any place on any meridian is at the rate of 15° in an hour ($\frac{1}{24}$ of 360°), or 1° in 4 minutes ($\frac{1}{15}$ of 60 minutes or 1 hour), or 1′ in 4 seconds ($\frac{1}{60}$ of 4 minutes), or 1″ in $\frac{4}{60}$ or $\frac{1}{15}$ of a second of time.

In reckoning the difference of time, therefore, between two places, it is only necessary to consider each

15° difference in longitude = 1 hour difference in time.
1° difference in longitude = 4 minutes difference in time.
1′ difference in longitude = 4 seconds difference in time.
1″ difference in longitude = $\frac{1}{15}$ second difference in time.

From the above analysis we deduce the following rules.

To find the difference of time between two places when their longitude is known.

RULE. — *Multiply the difference of longitude in degrees, minutes, and seconds, by* 4; and the product will be the difference of time in minutes, seconds, and sixtieths of a second, respectively.

To find the difference in the longitude of places when the difference of time is known.

RULE. — *Reverse the above process, — i. e., divide the difference of time in minutes, seconds, and sixtieths of a second, by* 4; and the quotient will be the difference of longitude in degrees, minutes, and seconds.

EXAMPLE 1. — The difference in longitude between Boston and St. Louis is 19° 11′ 9″: what is the difference of time?

OPERATION.
19° 11′ 9″
4
1h. 16m. $44\frac{3}{5}$ sec.

Since 1″ = $\frac{4}{60}$ of a second, 9″ = 9 × $\frac{4}{60}$ = $\frac{36}{60}$ = $\frac{3}{5}$ of a second of time; and since 1′ = 4 seconds of time, 11′ = 4 × 11 = 44 seconds; 44 + $\frac{3}{5}$ = $44\frac{3}{5}$ seconds. As 1° = 4 minutes, 19° = 4 × 19 = 76 minutes = 1 hour 16 minutes.

EXAMPLE 2. — The difference of time between Boston and St. Louis is 1 hour 16 minutes $44\frac{3}{5}$ seconds: what is the difference in longitude?

OPERATION.
4) 1h. 16m. $44\frac{3}{5}$ sec.
19° 11′ 9″

One hour (= 60 minutes) + 16 = 76 minutes; as 4 minutes = 1°, 76 minutes = 76 ÷ 4 = 19°. As 4 seconds = 1′, $44\frac{3}{5}$ seconds = $44\frac{8}{5}$ ÷ 4 = $11\frac{3}{20}$′; and $\frac{3}{20}$ of a minute of distance is equal to 9″.

THE METRIC SYSTEM.

THE METRIC SYSTEM of weights and measures is in general use on the Continent of Europe, and has been adopted by Congress as a standard in the United States, though it is not yet generally used here. It is, however, used by scientists, druggists, importers, and in the custom-houses.

The standard unit from which all others are derived is called METER, and is the unit of length, representing one ten-millionth part of the earth's quadrant, or of the distance from the equator to the pole. The word "meter" means "measure."

The *standard meter* is a bar of platinum kept at Paris, and with much care to prevent change in its length. Copies are kept at the capital of each country in which the system has been legally adopted.

The metric system is also called the *decimal system*, because all its multiples and subdivisions are powers of ten; hence operations are exactly the same as in simple numbers, and decimal instead of common fractions are universal.

The prefixes representing the subdivisions are —

DECI = one tenth of; as, DECI-METER, one tenth of a meter (.1 m.).
CENTI = one hundredth of; as, CENTI-METER, one hundredth of a meter (.01 m.).
MILLI = one thousandth of; as, MILLI-METER, one thousandth of a meter (.001 m.).

The prefixes representing the multiples are —

DEKA = ten; as, DEKA-METER, ten meters (10 m.).
HEKTO = one hundred; as, HEKTO-METER, one hundred meters (100 m.).
KILO = one thousand; as, KILO-METER, one thousand meters (1000 m.).
MYRIA = ten thousand; as, MYRIA-METER, ten thousand meters (10000 m.).

In the following tables the abbreviations are enclosed in curves after each order. The abbreviations of the multiples begin with capitals, and of the subdivisions with small letters, because thus they have been found more convenient for use.

TABLE OF LONG MEASURE.

	1 millimeter (*mm.*)	=	.001	meter.
10 millimeters	1 centimeter (*cm.*)	=	.01	"
10 centimeters	1 decimeter (*dm.*)	=	.1	"
10 decimeters	1 meter (*m.*)	=	1	"
10 meters	1 dekameter (*Dm.*)	=	10	"
10 dekameters	1 hektometer (*Hm.*)	=	100	"
10 hektometers	1 kilometer (*Km.*)	=	1000	"
10 kilometers	1 myriameter (*Mm.*)	=	10000	"

The unit used in measuring surfaces is a square whose sides are one meter in length; hence it is a SQUARE METER. Square each element of the above table and it will result in the table of

SQUARE MEASURE.

	1 square millimeter (*sq. mm.*)	=	.000001 square meter.	
100 square millimeters........	1 “ centimeter (*sq. cm.*)	=	.0001 “ “	
100 “ centimeters	1 “ decimeter (*sq. dm.*)	=	.01 “ “	
100 “ decimeters	1 “ meter (*sq. m.*)	=	1	sq. m. = 1 centar (*ca.*).
100 “ meters	1 “ dekameter (*sq. Dm.*)	=	100	“ = 1 ar (*a.*).
100 “ dekameters	1 “ hektometer (*sq. Hm.*)	=	10000	“ = 1 hektar (*Ha.*).
100 “ hektometers	1 “ kilometer (*sq. Km.*)	=	1000000	“

When used as a unit of land measure the square dekameter is called an AR, and its multiples and subdivisions are shown in the above table.

The *unit of measure of volume* is a cube, each of whose sides is one meter in length; hence it is a CUBIC METER.

Cube the elements of long measure and the result will be

CUBIC MEASURE.

	1 cubic millimeter (*cu. mm.*)	=	.000000001 cubic meter.	
1000 cubic millimeters	1 “ centimeter (*cu. cm.*)	=	.000001 “ “	
1000 “ centimeters	1 “ decimeter (*cu. dm.*)	=	.001	cu. m. = 1 liter.
1000 “ decimeters.............	1 “ meter (*cu. m.*)	=	1	“ “ = 1 ster.

&c.

The STER is used in measuring wood, equals one cubic meter, and is the unit of

WOOD MEASURE.

10 decisters (*ds.*)	1 ster (*s.*)	=	1 cubic meter.
10 sters.................................	1 dekaster (*Ds.*)	=	10 “ “

The *unit of measure of capacity*, corresponding to English liquid and dry measures, is equal in volume to one cubic decimeter, and is called the LITER, and its multiples and subdivisions are shown in the following table of

LIQUID AND DRY MEASURES.

	1 milliliter (*ml.*)	=	1 cu. cm.				
10 milliliters..................	1 centiliter (*cl.*)	=	10 “ “				
10 centiliters..................	1 deciliter (*dl.*)	=	100 “ “				
10 deciliters	1 liter (*l.*)	=	1000 “ “	=	1 cu. dm.		
10 liters.......................	1 dekaliter (*Dl.*)	=	10000 “ “	=	10 “ “		
10 dekaliters	1 hektoliter (*Hl.*)	=	100000 “ “	=	100 “ “		
10 hektoliters................	1 kiloliter (*Kl.*)	=	1000000 “ “	=	1000 “ “	=	1 cu. m.

The *unit of weight* is the weight of one cubic centimeter of distilled water at the temperature of 4° Centigrade, or 39.2° Fahrenheit, and is called the GRAM. Its multiples and subdivisions appear in the table of

WEIGHT.

10 milligrams (*mg.*)	1 centigram (*cg.*).
10 centigrams	1 decigram (*dg.*).
10 decigrams	1 gram (*g.*) = the weight of 1 cu. cm. of water.
10 grams	1 dekagram (*Dg.*).
10 dekagrams	1 hektogram (*Hg.*).
10 hectograms	1 kilogram (*Kg.*) = the weight of 1 cu. dm. of water = 1000 g.
10 kilograms	1 myriagram (*Mg.*) = 10000 g.
10 myriagrams	1 quintal (*Q.*) = 100000 g.
10 quintals	1 metric ton (*T.*) = 1000000 g. = 1000 Kg.

EQUIVALENTS.

As established by Act of Congress, for use in legal proceedings and in the interpretation of contracts.

1 centimeter = .3937 of an inch.
1 decimeter = .328 of a foot.
1 meter = 39.37 inches = 1.0936 yards.
1 dekameter = 1.9884 rods.
1 kilometer = .62137 of a mile.

1 square centimeter = .155 of a sq. inch.
1 " decimeter = .1076 of a sq. foot.
1 " meter = 1.196 sq. yards.
1 " dekameter = 3.954 sq. rods = 1 ar.
1 " hektometer = 2.471 sq. acres = 1 hectar.
1 " kilometer = .3861 of a sq. mile.

1 cubic centimeter = .061 of a cubic inch.
1 " decimeter = .0353 of a cubic foot = 1 liter.
1 " meter = 1.308 cubic yards = 1 ster = .2759 of a cord of wood.

1 liter = 1.0567 liquid quarts = .908 of a dry quart.
1 dekaliter = 1.135 pecks.
1 hektoliter = 2.8375 bushels.

$$\text{1 gram} = \begin{cases} \text{.03527 ounce avoirdupois.} \\ \text{.03215 `` troy.} \\ \text{15.432 grains ``} \end{cases}$$

$$\text{1 kilogram} = \begin{cases} \text{2.2046 pounds avoirdupois.} \\ \text{2.679 `` troy.} \end{cases}$$

1 metric ton = 1.1023 tons, or 2200 pounds.

1 inch = 2.54 centimeters.
1 foot = 3.048 decimeters.
1 yard = .9144 meter.
1 rod = 5.029 meters.
1 mile = 1609.3 meters, or 1.6093 Km.
1 ounce av. = 28.35 grams.
1 pound av. = 453.6 grams.
1 English ton = .9072 metric ton.

1 cord = 3.624 sters.
1 qt. dry = 1.101 liters.
1 qt. liquid = .9463 liter.
1 gallon = 3.785 liters.
1 peck = 8.81 liters.
1 bushel = 35.24 liters.
1 sq. rod = .2529 ar.
1 acre = 40.47 ars.

UNITED STATES MONEY.

The legal currency of the United States is called United States Money. It is in the decimal system, and consists of the denominations and relative values shown in the following

Table.

10 mills	1 cent (*ct*).	10 dimes	1 dollar ($).
10 cents	1 dime (*d.*).	10 dollars	1 eagle (*e.*).

The *unit* is the dollar, cents and mills being written as *decimals* of the dollar; cents occupy *two* decimal places (tenths and hundredths), and mills *one* place (thousandths), because it takes one hundred cents to make the unit (one dollar), and ten mills to make one cent.

In ordinary business, dollars and cents are the only denominations used, and they are written as whole numbers and decimals, and added, subtracted, multiplied, and divided exactly as simple numbers.

When written, the sign for dollars is usually placed before dollars; thus, five dollars and sixty-five cents in figures is $5.65. Five mills added to the $5.65 = 5.655. A comma is sometimes put between cents and mills, thus: $5.65,5, to mark it for reading as dollars, cents, and mills, instead of dollars and thousandths of a dollar.

Frequently cents are written and spoken of as parts of a dollar, as follows:—

$0.50 = ½ of a dollar.
.33⅓ = ⅓ of a dollar.
.66⅔ = ⅔ of a dollar.
.25 = ¼ of a dollar.
.75 = ¾ of a dollar.
$0.16⅔ = ⅙ of a dollar.
.12½ = ⅛ of a dollar.
.37½ = ⅜ of a dollar.
.62½ = ⅝ of a dollar.
.87½ = ⅞ of a dollar.

$75¼, $55⅜, $25½, etc.

The dollar sign ($) was intended, probably, to represent the letter U upon an S, denoting U. S.

CANADA MONEY

Consists, like United States money, of dollars and cents. The Canada coins are twenty-cent, ten-cent, five-cent, *silver;* and one-cent, *bronze.* English gold coins are much used in Canada; they consist of the sovereign and half-sovereign.

ENGLISH OR STERLING MONEY

Is the legal currency of Great Britain. The *unit of measure* is the pound (£), equal to $4.86,65 United States money.

TABLE.

4 farthings........................1 penny, or *d.*
12 pence..........................1 shilling, or *s.*
20 shillings..........1 pound, or sovereign = £.
21 shillings..........1 guinea, or *G.*

The coin of Great Britain consists of gold, silver, and copper.

GERMAN MONEY

Is the legal currency of the new German Empire. The *unit of measure* is the *mark*, equal to 238 mills, or $23\frac{8}{10}$ cents United States money.

The German Empire has, within the past few years, issued a new coin called the *mark*, which is now adopted as the money of that nation.

In commercial transactions the mark is not generally reckoned at its par value, but is governed by the quotations, which range at present between 91 cents and $1 for 4 marks. The market value of the mark is found by dividing the *quotation* by 4. For example, 400 marks at $0.95½ = $0.955 ÷ 4 × 400 = $95.50.

FRENCH MONEY

Is the legal currency of France. The *unit of measure* is the franc, equal to 193 mills, or $19\frac{3}{10}$ cents United States money.

TABLE.

10 millimes (*m.*) = 1 centime (*ct.*). | 10 centimes = 1 decime (*dc.*). | 10 decimes = 1 frank (*fr.*).

Millimes, like United States mills, are not coined.

The par value of the franc is 19 cents and 3 mills, but its commercial value varies according to the fluctuations of the money market. When exchange is quoted at say 5.17½, it is understood to mean that 5 francs and 17½ centimes are equal to the gold dollar. The gold of any given number of francs is, therefore, ascertained by dividing that number by the *quotation* or rate of exchange. For example, the cost of 9463 francs at 5.21½ = 9463 ÷ 5.215 = $1814.57.

PERCENTAGE.

PERCENTAGE is a charge, allowance, or estimate of a certain number of units on every hundred in a given number or quantity, and consists of a part of that on which it is reckoned. "Per cent" is a contraction of the Latin *per centum*, and means "by the hundred." Any per cent (written %) of a number, therefore, is so many hundredths of it, and may be expressed either by a decimal or a vulgar fraction. Generally the former method is used, thus: —

1 % = .01, or $\frac{1}{100}$.
3 % = .03, or $\frac{3}{100}$.
5 % = .05, or $\frac{5}{100} = \frac{1}{20}$.
10 % = .10, or $\frac{10}{100} = \frac{1}{10}$.
75 % = .75, or $\frac{75}{100} = \frac{3}{4}$.
½ % = .00½, or .005; or $\frac{½}{100} = \frac{1}{200}$.
¾ % = .00¾, or .0075; or $\frac{¾}{100} = \frac{3}{400}$.
12½ % = .12½, or .125; or $\frac{12½}{100} = \frac{1}{8}$.

In percentage the following terms are used: —

The *base* is the number upon which the percentage is computed.

The *rate* is the number of hundredths of the base taken.

The *percentage* is the number obtained by taking any given per cent of the base.

The *amount* is the base plus the percentage.

The *difference* is the base less the percentage.

All the possible problems involving percentage, however intricate they may appear, can be easily solved by means of the above definitions, and the following formulas or rules derived from them: —

I. Base × Rate = Percentage.
II. Percentage ÷ Base = Rate.
III. Percentage ÷ Rate = Base.

ILLUSTRATIVE EXAMPLES.

I. What is 6 % of $400? What is the amount?

Percentage = Base × Rate.
$400 × .06 = $24.
Amount = Base + Percentage.
$400 + $24 = $424.

II. What per cent of $850 is $51?

Rate = Percentage ÷ Base.
$51 ÷ $850 = .06, or 6 %.

III. 300 is 5 % of what number?

Base = Percentage ÷ Rate.
300 ÷ .05 = 6000.

SIMPLE APPLICATION OF PERCENTAGE.

The principal simple applications of Percentage are Commission, Profit and Loss, Insurance, Taxes, and Duties.

I. **Commission** is a fee or compensation of an agent, broker, factor, correspondent, salesman, or other representative, for services rendered, usually in buying and selling merchandise, real estate, etc. As commission is always a certain per cent of the sales or purchases, all its problems may be solved by applying the principles already stated in percentage. The *base* is the amount of sales or purchases; the *rate*, the per cent of commission; and the *percentage*, the commission itself. The net proceeds of a sale or collection are the sum left after deducting the commission and other charges.

Example. — I sold a parcel of goods for John Jones upon a commission of 6 %. The sales amounted to $5,050. My charges for storage, advertising, etc., were $6.20. What were the net proceeds?

Base × Rate = Percentage.
Therefore Sales × Rate = Commission.
Commission = $5,050 × .06 = $303.
Sales — (Commission + Charges) = Net Proceeds.
Therefore Net Proceeds = $5,050 — ($303 + $6.20) = $4,740.80

II. **Profit and Loss.** — Under this head are included computations relative to gains and losses in business or other transactions. In calculations on sales the following terms are used: The base is the cost; the rate is the number of per cent which the gain or loss is of the cost; the selling price is the cost plus the gain or minus the loss, and corresponds with the amount or difference in percentage; the gain or loss is the difference between the cost and the selling price.

The problems of profit and loss are all readily solved by the application of the simple principles of percentage.

Example. — If I sell a wagon which cost me $250, for $300, do I gain or lose? How much, and what per cent?

Selling Price — Cost = Gain.
Gain = $300 — $250 = $50.
Rate = Percentage ÷ Base.
= Gain ÷ Cost.
= $50 ÷ $250 = .20, or 20 %.

III. **Insurance** is security guaranteed by one party to another against loss, damage, or risk.

The *insurer* or *underwriter* is the party taking the risk (insurance business is generally conducted by joint-stock companies); the *insured* or *assured* is the party protected; the *policy* is the written contract between the parties; the *premium* is the sum paid for the insurance, and is usually reckoned at so much per cent of the amount insured. Hence insurance is computed by the principles of simple percentage. The principal kinds of insurance are fire, marine, and life.

(1.) *Fire insurance* is security against loss by fire, and is generally effected on buildings, merchandise, furniture, and the like.

(2.) *Marine insurance* is security against the loss of a vessel or cargo, on oceans, seas, lakes, rivers, etc. The policies used are of two kinds, viz., *closed* and *open*.

A *closed* or *valued* policy is one in which a specified amount or value of the vessel or goods is insured (and stated upon the making of the contract).

An *open* policy is one taken out for a certain amount, to remain open for a specified time for the insertion of such amount, not exceeding the amount named, as may be required to be insured within the specified time.

(3.) *Life insurance* is a contract which provides for the payment of a stipulated sum to the heirs of the insured, or other person at his death, or to himself at the expiration of a specified term of years. The policy in the former case is called a *life policy;* in the latter, an *endowment policy*. The rates of premium in this sort of insurance are based upon the expectation of life of persons insured and the rate of interest which may be obtained by investing money received for premiums.

Examples. — (1.) Required the cost of insuring a house for \$4,000 at a premium of $\frac{3}{4}$% per annum, allowing \$1.50 for the policy, and 25 cents for revenue stamps.

Base × Rate = Percentage.
Therefore Amount of Premium = Amount Insured × Rate.
\$4,000 × .0075 = \$30.
Total Cost of Insurance = Premium + Charges.
\$30 + \$1.50 + \$0.25 = \$31.75.

(2.) Shipped on board the "Queen" for London, goods valued at \$14,500. What will be the cost of insurance at a premium of 2%, allowing \$1.50 for the policy, and 25 cents for revenue stamps?

Percentage = Base × Rate.
Therefore Premium = Amount insured × Rate.
\$14,500 × .02 = \$290.
Total Cost of Insurance = Premium + Charges.
= \$290 + \$1.50 + \$0.25 = \$291.75.

IV. Taxes. — A tax is a sum of money assessed upon the person or property of an individual, for public purposes.

A *poll* or *capitation* tax is a certain sum required from each citizen liable to taxation, without regard to property. The word *poll* signifies head; and hence is used to signify a person who pays a poll-tax.

A *property tax* is a tax on property, and is reckoned at a certain rate per cent of the estimated value of each person's property.

An *income tax* is a tax on income, and is reckoned at a certain rate per cent of the annual income of the tax-payer.

For the purpose of assessing taxes, assessors are appointed to estimate the value of taxable property of the inhabitants of a town, city, or district, and where a poll-tax is to be levied, to make a list of the polls.

Rules for working Examples in Taxation.

(1.) Find the amount of poll-tax, if any, and subtract it from the whole tax to be assessed; the remainder will be the property and income tax.

(2.) Divide the property and income tax by the whole amount of taxable property and income; the quotient will be the rate of taxation.

(3.) Multiply each man's taxable property and income by the rate of taxation, and to the product add his poll-tax, if any; the result will be the whole amount of his tax.

Example. — In a certain town a tax of $5,000 is to be assessed. There are 500 polls to be assessed $1 each, and the valuation of taxable property and income is $1,000,000: what is the rate of taxation, and how much will be A's tax, when his property and income are valued at $5,000, and he has to pay for 2 polls?

$1 × 500 = $500, Amount assessed on the polls.
$5,000 — $500 = $4,500, Amount to be assessed on property and income.
$4,500 ÷ 1,000,000 = .0045, Rate of taxation.
$5,000 × .0045 = $22.50, A's property and income tax.
$1 × 2 = 2. A's poll-tax.
$24.50 Amount of A's tax.

V. *Duties* or *customs* are taxes levied on imported goods, for the support of government and the protection of home industry.

A *specific* duty is one charged upon quantity, without regard to cost.

An *ad valorem* duty is one charged upon the value of the goods at the last port of exportation.

Tare is an allowance deducted before estimating the duties, for the weight of the box, cask, or bag containing the goods.

Gross weight is the weight of goods with the box, bag, etc., containing them.

Net weight is the weight of goods after all deductions are made.

Leakage is an allowance on liquors imported in casks or barrels, and is ascertained by gauging. Breakage is an allowance on liquors imported in bottles.

The *dutiable value of merchandise*, under the present law, is the original cost or actual wholesale price, in addition to commissions (in no case less than 2½ per cent) and general charges incurred in the purchase; and also the cost of transportation, shipment, and transshipment, with all the expenses included, from the place of growth, production, or manufacture, whether by land or water, to the vessel in which shipment is made to the United States.

Example. — What is the duty, @ 24 per cent, on an invoice of cassimere goods which cost $1250 ?

$1250 × .24 = $300.

INTEREST.

Interest is a sum paid for the use of money.

The *principal* is the sum (base) for the use of which interest is paid.

The *rate* is the per cent paid for the use of the principal, and is usually per annum or for a year.

The *amount* is the sum of the principal and interest.

Simple interest is interest upon the principal only.

Compound interest is interest upon both principal and interest.

As the legal rate of interest in twenty-two States of the Union is six per cent, the following brief rule will prove beneficial.

Rule, Six Per Cent Method.

1. To find the rate (interest on $1) for a given time, call every year $.06, every two months $.01, every six days $.001, and every less number of days sixths of a mill.
2. To find the interest, multiply the principal by the rate as above ascertained.

To find the interest at any rate per cent by this method, first find it at six per cent, and then increase or diminish the result by as many sixths as the given rate is units greater or less than six per cent.

EXAMPLE. — What is the interest of $1,600 for 2 years, 4 months, 19 days, @ 7 per cent?

$$\begin{array}{llcl}
2 \times & \$.06 & = & \$.12 \\
2 \times & .01 & = & .02 \\
3 \times & .001 & = & .003 \\
1 \times & .000\frac{1}{6} & = & .000\frac{1}{6} \\
\cline{4-4}
 & & & .143\frac{1}{6} \text{ Rate @ 6 \%}
\end{array}$$

$$\begin{array}{r}
1600 \\
.143\frac{1}{6} \\
\hline
266\frac{2}{3} \\
4800 \\
6400 \\
1600 \\
\hline
229.066
\end{array}$$

$$\begin{array}{r}
6)\ 229.066 \\
\hline
38.177\frac{2}{3} \\
\hline
\text{Ans. } \$267.243.
\end{array}$$

Government or Accurate Rules to find the Interest.

Rule, —

1. Find the interest for years by ordinary percentage methods; but for any fraction of a year take such part of one year's interest as the number of days is of 365.

2. Compute the interest by the common method for years, and from the interest for the fractional part of a year subtract $\frac{1}{73}$ part of itself.

EXAMPLE.

$$\begin{array}{rl}
1600 & \\
.07 & \\
\hline
112.00 & \text{Int. for 1 year.} \\
2 & \\
\hline
224.00 & \text{Int. for 2 years.} \\
42.65 & \\
\hline
\$266.65 & \text{Int. for 2 y. 4 m. 19 ds.}
\end{array}$$

4 mos. 19 days = 139 days.

$$\begin{array}{rrl}
 & 112 & \\
 & 139 & \\
\cline{2-2}
 & 1008 & \\
 & 336 & \\
 & 112 & \\
\cline{2-2}
365) & 15568 & (42.652 \\
 & 1460 & \\
\cline{2-2}
 & 968 & \\
 & 730 & \\
\cline{2-2}
 & 2380 & \\
 & 2190 & \\
\cline{2-2}
 & 1900 & \\
 & 1825 & \\
\cline{2-2}
 & 750 & \\
 & 730 & \\
\cline{2-2}
\end{array}$$

The following tables represent, in dollars and cents, the interest of different sums of money, from $1 to $1,000, for the periods of time indicated in the left-hand column. The numbers at the head of the columns show the amounts upon which interest has been reckoned.

INTEREST TABLE — SIX PER CENT.

TIME.	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	$100	$1,000
1 day	0	0	0	0	0	0	0	0	0	0	2	17
2 days	0	0	0	0	0	0	0	0	0	0	3	33
3 "	0	0	0	0	0	0	0	0	0	1	5	50
4 "	0	0	0	0	0	0	0	1	1	1	7	67
5 "	0	0	0	0	0	1	1	1	1	1	8	83
6 "	0	0	0	0	1	1	1	1	1	1	10	1 00
7 "	0	0	0	0	1	1	1	1	1	1	12	1 17
8 "	0	0	0	1	1	1	1	1	1	1	13	1 33
9 "	0	0	0	1	1	1	1	1	1	2	15	1 50
10 "	0	0	1	1	1	1	1	1	2	2	17	1 67
11 "	0	0	1	1	1	1	1	1	2	2	18	1 83
12 "	0	0	1	1	1	1	1	2	2	2	20	2 00
13 "	0	0	1	1	1	1	1	2	2	2	22	2 17
14 "	0	0	1	1	1	1	2	2	2	2	23	2 33
15 "	0	1	1	1	1	2	2	2	2	3	25	2 50
16 "	0	1	1	1	1	2	2	2	2	3	27	2 67
17 "	0	1	1	1	1	2	2	2	3	3	28	2 83
18 "	0	1	1	1	2	2	2	2	3	3	30	3 00
19 "	0	1	1	1	2	2	2	3	3	3	32	3 17
20 "	0	1	1	1	2	2	2	3	3	3	33	3 33
21 "	0	1	1	1	2	2	2	3	3	4	35	3 50
22 "	0	1	1	1	2	2	3	3	3	4	37	3 67
23 "	0	1	1	2	2	2	3	3	3	4	38	3 83
24 "	0	1	1	2	2	2	3	3	4	4	40	4 00
25 "	0	1	1	2	2	3	3	3	4	4	42	4 17
26 "	0	1	1	2	2	3	3	3	4	4	43	4 33
27 "	0	1	1	2	2	3	3	4	4	5	45	4 50
28 "	0	1	1	2	2	3	3	4	4	5	47	4 67
29 "	0	1	1	2	2	3	3	4	4	5	48	4 83
1 month	1	1	2	2	3	3	4	4	5	5	50	5 00
1 year	6	12	18	24	30	36	42	48	54	60	6 00	60 00

NOTE — *Fractions of Interest.* — When the fraction of interest is half a cent or more, a whole cent is taken; but when it is less than half a cent, nothing is charged. The same rule is observed with respect to cents forming a part of the principal: if they amount to half a dollar or upward, the discount is taken as for a whole dollar; when they do not amount to half a dollar, they are disregarded. This is the rule generally pursued by banks and mercantile houses.

PARTIAL PAYMENTS.

PARTIAL PAYMENTS is payment in part of a note, bond, or other obligation. The following rule for computing interest in partial payments is based on a decision of Chancellor Kent of the Supreme Court of the United States, and has been adopted by all the States of the Union except Vermont, New Hampshire, and Connecticut, hence may be called

UNITED STATES RULE.

1. Find the amount of the given principal to the time of the first payment, and if this payment exceed the interest then due, subtract it from the amount obtained, and treat the remainder as a new principal.

2. But if the interest be greater than any payment, compute the interest on the same principal to a time when the sum of the payments shall equal or exceed the interest due, and subtract the sum of the payments from the amount of the principal; the remainder will form a new principal, with which proceed as before.

INTEREST TABLE—SEVEN PER CENT.

TIME.	$1	$2	$3	$4	$5	$6	$7	$8	$9	$10	$100	$500	$1,000
1 day	0	0	0	0	0	0	0	0	0	0	2	10	19
2 days	0	0	0	0	0	0	0	0	0	0	4	19	39
3 "	0	0	0	0	0	0	0	0	1	1	6	29	58
4 "	0	0	0	0	0	0	1	1	1	1	8	39	78
5 "	0	0	0	0	0	1	1	1	1	1	10	48	97
6 "	0	0	0	0	1	1	1	1	1	1	12	58	1 17
7 "	0	0	0	1	1	1	1	1	1	1	14	68	1 36
8 "	0	0	0	1	1	1	1	1	1	2	16	78	1 56
9 "	0	0	1	1	1	1	1	1	2	2	18	88	1 75
10 "	0	0	1	1	1	1	1	2	2	2	19	97	1 94
11 "	0	0	1	1	1	1	1	2	2	2	21	1 07	2 14
12 "	0	0	1	1	1	1	2	2	2	2	23	1 17	2 33
13 "	0	1	1	1	1	2	2	2	2	3	25	1 26	2 53
14 "	0	1	1	1	1	2	2	2	2	3	27	1 36	2 72
15 "	0	1	1	1	1	2	2	2	3	3	29	1 46	2 92
16 "	0	1	1	1	2	2	2	2	3	3	31	1 56	3 11
17 "	0	1	1	1	2	2	2	3	3	3	33	1 66	3 31
18 "	0	1	1	1	2	2	2	3	3	4	35	1 75	3 50
19 "	0	1	1	1	2	2	3	3	3	4	37	1 85	3 69
20 "	0	1	1	2	2	2	3	3	4	4	39	1 94	3 89
21 "	0	1	1	2	2	2	3	3	4	4	41	2 04	4 08
22 "	0	1	1	2	2	3	3	3	4	4	43	2 14	4 28
23 "	0	1	1	2	2	3	3	4	4	4	45	2 24	4 47
24 "	0	1	1	2	2	3	3	4	4	5	47	2 34	4 67
25 "	0	1	1	2	2	3	3	4	4	5	49	2 43	4 86
26 "	1	1	2	2	2	3	4	4	5	5	51	2 53	5 06
27 "	1	1	2	2	2	3	4	4	5	5	53	2 63	5 25
28 "	1	1	2	2	2	3	4	4	5	5	54	2 72	5 44
29 "	1	1	2	2	2	3	4	5	5	6	56	2 82	5 64
1 month	1	1	2	2	3	4	4	5	5	6	58	2 92	5 83
1 year	7	14	21	28	35	42	49	56	63	70	7 00	35 00	70 00

CONNECTICUT RULE.

1. Payments made one year or more from the time the interest commenced, or from another payment, and payments less than the interest due, are treated according to the United States rule.

2. Payments exceeding the interest due and made within one year from the time interest commenced, or from a former payment, shall draw interest for the balance of the year, provided the interval does not extend beyond the settlement, and the amount must be subtracted from the amount of the principal for one year; the remainder will be the new principal.

3. If the year extend beyond the settlement, then find the amount of the payment to the day of settlement, and subtract it from the amount of the principal to that day; the remainder will be the sum due.

VERMONT RULE.

1. Find the amount of the principal from the time interest commenced to the time of settlement.

2. Find the amount of each payment from the time it was made to the time of settlement.

3. Subtract the sum of the amounts of the payments from the amount of the principal; the remainder will be the sum due.

NEW HAMPSHIRE RULE.

1. Find the amount of the principal for one year, and deduct from it the amount of each payment of that year, from the time it was made up to the end of the year; the remainder will be a new principal, with which proceed as before.

2. If the settlement occur less than a year from the last annual term of interest, make the last term of interest a part of a year accordingly.

COMPOUND INTEREST.

Compound Interest is interest on both principal and interest when the interest is not paid when due.

Rule, —

1. Find the amount of the given principal at the given rate for one year, and make it the principal for the second year.
2. Find the amount of this new principal and make it the principal for the third year, and so continue to do for the given number of years.
3. Subtract the given principal from the last amount, the remainder will be the compound interest

DISCOUNT.

Discount is an allowance or deduction made for the payment of a debt before it becomes due.

The *present worth* of a debt payable at a future time, without interest, is such a sum as, being put at legal interest, will amount to the given debt when it becomes due.

True Discount is the difference between the present worth and the amount of the debt.

Rule to find the true discount, —

1. Divide the sum or debt by the amount of $1 for the given time at the given rate, the quotient will be the present worth of the debt.
2. Subtract the present worth from the given sum or debt, the remainder will be the true discount.

Example. — What is the present worth, and what the discount, of $1,284.24, to be paid 4 years, 9 months, 27 days hence, money being worth 7 %?

$1.33775, Amount of $1 for the given time.
$1284.24 ÷ 1.33775 = $960, Present worth.
$1284.24 — $960 = $324.24, True discount.

Banks will frequently cash notes or other negotiable paper long before due, in that case charging what is called *bank discount*, which is simply interest on the principal for the given time (plus three days, called days of grace), taken in advance.

Rule, —

1. Compute the interest on the face of the note for three days more than the specified time, the result will be the discount.
2. Subtract the discount from the face of the note, the remainder will be the proceeds.

Example. — What is the bank discount and what are the proceeds of a note for $2487 due in 30 days @ 6 %?

.005½ or .0055 = interest on $1 for given time.
$2487 × .0055 = $13.68 = bank discount.
$2487 — $13.68 = $2473.32 = net proceeds.

EXCHANGE.

Exchange is remitting money by written orders, as exemplified and fully discussed in the chapter on Book-Keeping in another part of this work. There are two kinds of *exchange*, domestic and foreign.

Domestic exchange covers remittances made to different places in the same country.

Foreign exchange covers remittances between different countries.

A *bill of exchange* is a written request or order upon one person to pay a certain specified sum to another person, or to his order, at a given time.

The *face* of a bill of exchange is the sum ordered to be paid.

The *par of exchange* is the estimated value of the coins of one country as compared with those of another, and is either intrinsic or commercial.

The *intrinsic par* of exchange is the comparative value of the coins of different countries as determined by their weight and purity.

The *commercial par* of exchange is the comparative value of the coins of different countries as determined by their nominal or market price.

The *course of exchange* is the current price paid in one place for bills of exchange on another place.

DOMESTIC EXCHANGE.

Rule, —

1. To find the cost of a draft, the face being given, multiply the face of the draft by the cost of exchange for $1.

2. To find the face of a draft, the cost being given, divide the given cost by the cost of exchange for $1.

The cost of exchange for $1 may always be found by subtracting from the course of exchange the bank discount, at the legal rate where the draft is made, for the specified time.

Example. — What will be the cost of a 60 days' draft for $800 in Pittsburg, on Boston, at 2¼ % premium?

$1 + $0.0225 = $1.0225, course of exchange.
.0105, bank discount of $1.
$1.012 cost of exchange for $1.

$800 × 1.012 = $809.60 = cost of entire draft.

Example. — What is the face of a 60 days' draft which I can purchase in Baltimore, on Philadelphia, when exchange is at 2 % discount?

$1 — $0.02 = $0.98, course of exchange.
.0105, bank discount of $1.
.9695, cost of exchange for $1.

FOREIGN EXCHANGE.

Rule,—

1. To find the cost of a bill, the face being given, multiply the value of a monetary unit, according to the course of exchange, by the number of such units in the face of the bill.
2. To find the face of a bill, the cost being given, divide the cost of the bill by the value of each monetary unit, according to the course of exchange.

Exchanges with Europe are effected chiefly through the following cities: London, Paris, Antwerp, Amsterdam, Hamburg, Frankfort, Bremen, and Berlin. In exchange on Paris, Switzerland, and Antwerp, the unit is the *franc*, and the quotations show the number of francs and centimes to our dollar. In exchange on Amsterdam, the unit is the guilder, quoted at its value in cents; on Hamburg, Bremen, Berlin, and Frankfort, the quotations show the value of four reichsmarks (marks) in cents.

Example.—What will be the cost, in New York, of a bill of exchange on London, for £864, the course of exchange being $4.875?

$4.875 = value of £1 = course of exchange.
$4.875 × 864 = $4212, cost of bill.

Example.—What is the face of a bill on Liverpool, that may be purchased in New York for $554.84, exchange being quoted at $4.85?

$554.84 ÷ 4.85 = £114.4 = £114 8*s*., face.

EQUATION OF PAYMENTS.

Equation of Payments is the process of finding the mean or equitable time of payment of several sums due at different times without interest.

The methods of equating payments are based upon the principle that interest or use of any sum of money paid before it is due is equivalent to interest or use of an equal sum retained for some length of time after it becomes due; and the process simply consists in finding a point when the interest, on sums then overdue, realizes discount on sums not due, reckoning discount as simple interest (which, though not strictly accurate, is nevertheless customary).

The *equated time* is the date at which several debts may be cancelled by one payment.

Rule,—

1. Assume any date as a focal date (best, the earliest date upon which a payment is due).
2. Multiply each sum by the time between this focal date and the date of its maturity, and divide the sum of the products by the amount of the debts. The quotient will be the time, in the same denomination as the multipliers, to be reckoned forward from the focal date to find the equated time.

Example.—Johnson, Jones & Co. owe H. Boomer & Co. as follows:—

Bought, May 10,	Merchandise,	@ 60 days,	$450;	due July 10,	0 days ×	$450 =	0000
“ July 15,	“	“ 30 “	850;	“ Aug. 15,	36 “ ×	850 =	30600
“ Sept. 1,	“	“ 90 “	500;	“ Dec. 1,	144 “ ×	500 =	72000
“ “ 2,	“	“ 60 “	862;	“ Nov. 2,	115 “ ×	862 =	99130
“ Oct. 20,	“	“ 60 “	325;	“ Dec. 20,	163 “ ×	325 =	52975
						$2987)	254705

85 days from July 10 = Oct. 3. 85 days.

Compound average is the process of finding the mean or equitable time for the payment of the balance of an account containing both debits and credits.

The *equated time* is the date when there is an equilibrium of interest between the two sides, so that the balance of the account is then due without interest.

Rule,—

1. Assume any date as a focal date for both sides of the account (best, the earliest date of maturity on either side).

2. Multiply each sum by the time between this focal date and the date of its maturity, and divide the balance of the products by the balance of the account.

The quotient reckoned from the focal date forward, if the balance of the products and the balance of the account are on the same side, but backward if on opposite sides of the account.

Example.—Find the equation of time for the following account:—

Johnson, Jones & Co. in % with H. Boomer & Co., Dr.

May 10, merchandise,	@ 60 days	$450	July 10, cash		$450
July 15, "	" 30 "	850	Aug. 15, note	@ 30 days	300
Sept. 1, "	" 90 "	500	Dec. 1, cash		800
" 2, "	" 60 "	862			
Oct. 20, "	" 60 "	325			

Solution.—July 10.—Focal Date.

Due.	Days.	Amt.		Due.	Days.	Amt.	
July 10	0 ×	$450 =	00000	July 10	0 ×	$450 =	00000
Aug 15	36 ×	850 =	30600	Sept. 15	67 ×	300 =	20100
Dec. 1	144 ×	500 =	72000	Dec. 1	144 ×	800 =	115200
Nov. 2	115 ×	862 =	99130			$1550	135300
Dec. 20	163 ×	325 =	52975				
		$2987	254705				
		1550	135300				
		$1437)	119405				
			83 days.	Balance due 83 days from July 10, that is, Oct. 1.			

RATIO.

Ratio is the relative value of numbers or quantities of the same kind. It is usually expressed by placing two dots between the numbers compared, thus, 12 : 2, which indicates the ratio of 12 to 2, or the division of 12 by 2, sometimes written in the form of a fraction, thus, $\frac{12}{2}$.

Properly, the ratio is *not* the result of the performance of the division thus expressed, which would be 6, but is the relation expressed by the numbers when both have been divided by the denominator, or $\frac{12}{2} = \frac{6}{1}$ or 6 : 1; the relative value of 12 to 2 being, in its simplest form, as 6 is to 1. So with any numbers compared, as 25 to 6; the ratio is not simply $25 \div 6 = 4\frac{1}{6}$, but it is $\frac{25}{6} = \frac{4\frac{1}{6}}{1} = 4\frac{1}{6} : 1$; that is, as $4\frac{1}{6}$ is to 1.

The numbers compared are the *terms* of the ratio, sometimes called a *couplet.* The first term is called the *antecedent*, and the second is called the *consequent.*

The *antecedent* represents the *numerator* or *dividend*; and the *consequent*, the *denominator* or divisor. This form is called a *direct* ratio.

An *inverse* or *reciprocal* ratio is a *direct* ratio inverted ; that is, the *antecedent* used as the *divisor*, and the *consequent* as the dividend.

Since a ratio is an expression of division, its value may be changed exactly as the value of a quotient is changed in simple division.

The *terms* of a ratio must be of the same kind, as dollars to dollars, feet to feet, etc.; they cannot be as dollars to feet, or feet to pounds, etc.

A ratio is *simple* when two whole numbers are compared, as 8 : 4, 6 : 3, etc.

A ratio is *complex* when either of its terms is a fraction, as $6 : 2\frac{1}{2}$, $4\frac{1}{2} : \frac{3}{4}$, etc. In such case the ratio must be reduced to a simple one, just as a complex fraction is reduced to a simple fraction.

A ratio is *compound* when the corresponding terms of two or more simple ratios are to be united in one product, as $\frac{4}{8} : \frac{2}{4}$. In such case the ratio may be reduced to a single one, exactly as a compound fraction is reduced to a simple fraction, and *cancellation* may be used.

PROPORTION.

PROPORTION is an equality of ratios. An equality of ratios is usually expressed by placing four dots between two ratios: thus, 4 : 2 : : 6 : 3, which indicates that the ratio of 4 to 2 equals the ratio of 6 to 3. It is sometimes written thus, $4 : 2 = 6 : 3$.

The *terms* of the proportion are the terms of the ratios.

The *first* and *last* terms of the proportion are called the *extremes;* the *second* and *third* the *means;* the first and third terms are the *antecedents*, and the second and fourth are the *consequents.*

When the *means* are alike, the number representing them is called a *mean* proportional between the extremes. Thus, in 12 : 6 : : 6 : 3, 6 is a mean proportional between 12 and 3.

The product of the extremes of a proportion always equals the product of the means; since in *every* proportion the antecedents, as also the consequents, are virtually alike. Thus in the proportion 12 : 4 : : 15 : 5, the ratios may be reduced so that the terms of the proportion will be 3 : 1 : : 3 : 1, in which the *virtual* likeness of the antecedents and consequents of the first proportion has become *actual.* Hence, $3 \times 1 = 1 \times 3$, or the product of the extremes equals the product of the means, because the extremes are like the means.

It follows that, —

If the extremes and one of the means be given, the other mean may be found by dividing the product of the extremes by the given mean.

If the means and one extreme be known, the other extreme may be ascertained by dividing the product of the means by the known extreme.

If, therefore, any three terms of a proportion be known, the fourth may be determined. On this account proportion was formerly called the Rule of Three.

SIMPLE PROPORTION is an equality between two simple ratios.

If a man earn $50 in four weeks, how much will he earn at the same rate in one year of fifty-two weeks?

OPERATION.

Extreme. Mean. Mean. Extreme.
4 weeks : 52 weeks : : $50 : $650.

$$\frac{\overset{13}{\cancel{52}} \times 50}{\underset{1}{\cancel{4}}} = \frac{650}{1} = 650.$$

We have seen that ratios must be between numbers of the same kind. Hence in this problem one ratio must be between 4 weeks and 52 weeks; and the other ratio must be between $50 and the number of dollars in the fourth term of the proportion. We have then the first extreme and the two means to find the other extreme. We know that $50 is the third term of the proportion, because it is of the same kind as the required fourth term, according to the conditions of the question. It remains to determine which of the other known terms is first, and which is second.

In examining the question we find that \$50, the third term, represents the number of dollars the man can earn in four weeks. Since he must earn more in 52 weeks than in 4 weeks, the fourth term must be larger than the third term; and as the consequent of the second ratio of the proportion is larger than its antecedent (50), the consequent of the first ratio must be correspondingly larger than its antecedent. Hence 52 must be the second term, and 4 the first term of the proportion. The means are therefore 52 and 50, and the given extreme is 4. The product of the means divided by the extreme gives the required fourth term, 650. We have represented the process by cancellation.

From this discussion we obtain the following

Rule. — *Write as the third term of the proportion that number which is the same in kind as the answer, or fourth term, required.*

When the conditions of the question require the fourth term to be larger than the third, write the larger remaining number for the second term, and the less for the first; but when the fourth term should be less than the third, write the smaller remaining number for the second term, and the larger for the first.

Divide the product of the second and third terms by the first.

Solution of the problem by analysis : —

If a man earn \$50 in 4 weeks, he would earn $\frac{1}{4}$ of \$50, or \$12½, in 1 week; and in 52 weeks he would earn 52 times as much as in 1 week, or 52 times \$12½ = \$650.

Compound Proportion is an expressed equality between a compound and a simple ratio. The *compound ratio* may have any number of couplets.

$\left.\begin{array}{r}4 : 6\\ 8 : 2\\ 3 : 12\end{array}\right\} : : 9 : 13\tfrac{1}{2}$ and $\left.\begin{array}{r}3 : 5\\ 5 : 15\end{array}\right\} : : 1 : 5$ are compound proportions.

If we reduce the compound ratios to simple ratios in these proportions, by multiplying together the corresponding terms of the compound ratios, we shall have as a result the following simple proportions: —

96 : 144 : : 9 : 13½, and 15 : 75 : : 1 : 5.

If 12 horses eat 63 bushels of corn in 21 days, how many bushels will 20 horses eat in 40 days?

OPERATION.

$$\begin{array}{cccc}\text{Extreme.} & \text{Mean.} & \text{Mean.} & \text{Extreme.}\end{array}$$

$$\left.\begin{array}{r}12 : 20\\ 21 : 40\end{array}\right\} : : 63 : 200.$$

$$\frac{\overset{5}{\cancel{20}} \times 40 \times \overset{\overset{1}{\cancel{3}}}{\cancel{63}}}{\underset{\underset{1}{\cancel{3}}}{\cancel{12}} \times \underset{1}{\cancel{21}}} = \frac{200}{1} = 200 \text{ Ans.}$$

We make 63 the third term of the proportion, because it represents bushels of corn; hence is of the same kind as the fourth term required. To determine which of the remaining terms of the problem should be first, and which second terms of the proportion, we consider whether, according to the conditions of the problem concerning any two like terms, the fourth term of the proportion should be greater or less than the third term; if greater, we make the greater number the second and the less the first term; if less, we make the smaller number the second and the greater the first term.

Since, in the same length of time, 20 horses would eat more than 12 horses, considering these terms alone, the fourth term must be greater than 63, the bushels of corn eaten by 12 horses in a given time; hence we make 20 the second term, and 12 the first term; and since the same number of horses would eat more in 40 than in 21 days, considering these terms alone, the fourth term must be greater than 63, the amount eaten in 21 days; hence we make 40 the second term, and 21 the first term.

We have then, for the means of the proportion, 20, 40, and 63, whose product is to be divided by the product of the terms in the first extreme, 12 and 21. Having expressed this operation, we obtain the result by the process of cancellation.

It will thus be seen that the principle of *compound* proportion is precisely as in *simple* proportion, and the only difference is in the number of terms employed, all of which except one, the third term, must be either antecedents or consequents of the first or compound ratio; that is, first or second terms of the proportion. The third is always like, in *kind* and *condition*, the fourth term required, and no other term is like it in both these respects.

From this discussion we deduce the following

RULE. — *Write for the third term that given number which is like, in kind and condition, the fourth term required. Determine as in simple proportion which of any two like terms should be the first, and which the second term. When all the couplets have been thus determined, divide the product of the second and third terms by the product of the first term.*

NOTE. — Whenever surface or solid dimensions enter into a problem, it is only necessary to determine where one dimension belongs, and the others may be written in the same term; because it is a surface or solid that is really under consideration, not simply length, nor breadth, nor thickness. Thus, if in a problem two walls are represented, one 60 feet long, 5 feet thick, and 12 feet high; the other 40 feet long, 4 feet thick, 10 feet high. When it has been determined that 60 belongs either to the first or second term, the 5 feet and 12 feet may be written in the same term, because they are a part of the same solid; and 40, 4, and 10 may be written in the other term, as follows: —

$$\left.\begin{array}{r} 60 : 40 \\ 5 : 4 \\ 12 : 10 \end{array}\right\} : : \text{ or, } \qquad \left.\begin{array}{r} 40 : 60 \\ 4 : 5 \\ 10 : 12 \end{array}\right\} : :$$

Solution of the above problem by analysis: —

If 12 horses eat 63 bushels of corn in 21 days, they will eat as many bushels in 1 day as 21 is contained times in 63, or 3 bushels; and 1 horse would eat $\frac{1}{12}$ as much as 12 horses, or $\frac{1}{12}$ of $3 = \frac{3}{12}$ or $\frac{1}{4}$ of a bushel in 1 day; 20 horses would eat 20 times as much as 1 horse, or 20 times $\frac{1}{4} = 5$ bushels in 1 day; and in 40 days they would eat 40 times as much as in 1 day, or 40 times 5 bushels $= 200$ bushels.

If 4 men thrash 20 bushels of oats in 6 hours, how long will it take 2 men to thrash 5 bushels?

OPERATION.

$$\left.\begin{array}{r} 2 : 4 \\ 20 : 5 \end{array}\right\} : : 6 : 3.$$

$$\frac{\overset{1}{\cancel{4}} \times \overset{1}{\cancel{5}} \times \overset{3}{6}}{\underset{\underset{1}{\cancel{5}}}{\cancel{20}} \times \underset{1}{\cancel{2}}} = \frac{3}{1} = 3 \text{ hours, Ans.}$$

As the fourth term is to be hours, we make 6 hours the third term. As it will take 2 men longer than it will 4 men to do the same amount of work, as respects these terms alone, the fourth term would be larger than the third term; hence we write 4 for the second term and 2 for the first term. It would take the same number of men a less time to thrash 5 bushels than it would to thrash 20 bushels, hence, as regards these terms alone, the fourth term would be smaller than the third term; we therefore write 20 for the first term, and 5 for the second term.

Solution by analysis: —

If 4 men thrash 20 bushels in 6 hours, 1 man would thrash $\frac{1}{4}$ of 20, or 5, bushels in 6 hours, and in 1 hour he would thrash $\frac{1}{6}$ as much as in 6 hours, or $\frac{1}{6}$ of $5 = \frac{5}{6}$ of a bushel; 2 men would thrash 2 times as much as 1 man, or $2 \times \frac{5}{6} = \frac{10}{6}$ bushels in 1 hour, and it would take them as many hours to thrash 5 bushels as the amount they could thrash in 1 hour is contained times in 5 bushels, or $5 \div \frac{10}{6} = \frac{5}{1} \times \frac{6}{10} = \frac{30}{10} = 3$ hours.

INVOLUTION.

INVOLUTION is the process of obtaining the powers of quantities.

A *power* of a number is the product resulting from the use of the number any number of times as a factor.

The *first power* is the number itself, which is the *root* of the other powers.

The *second power* is the product of the number taken twice as a factor, and generally the *name* of the *power* is determined by the number of times the number is used as a factor.

The number of times it is employed as a factor is indicated by a small figure written at the right, and near the top of the root. This figure is called the INDEX or EXPONENT of the power.

The second power, or square of $3 = 3^2 = 3 \times 3 = 9$.
The third power, or cube of $3 = 3^3 = 3 \times 3 \times 3 = 27$.
The fourth power of $3 = 3^4 = 3 \times 3 \times 3 \times 3 = 81$.

To raise a number to any required power : —

RULE. — *Use the number as a factor as many times as there are units in the index of the power.*

NOTE. — (1.) To indicate that a whole fraction, and not simply its numerator, is to be raised to a power, the fraction must be enclosed in a parenthesis, thus $(\frac{4}{5})^3$ signifies that $\frac{4}{5}$ is to be used as a factor 3 times, $\frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = \frac{64}{125}$; but $\frac{4^3}{5}$ indicates only that 4 is to be used as a factor 3 times, $\frac{4^3}{5} = \frac{64}{5}$.

NOTE. — (2.) To raise a decimal to any power is the same as to raise a whole number. The number of decimal places in the power will equal those of the root, multiplied by the index of the power; thus, $.04^3 = .04 \times .04 \times .04 = .000064$.

NOTE. — (3). The powers of a number less than unity are less than the number itself.

EVOLUTION.

EVOLUTION is the opposite of involution, and is the process of finding the *root* used as a factor in producing the *power*.

The *root* has the same name as the *power*. Thus, the *second power* or *square* is resolved into its factors by obtaining the *square root;* the *third power* or *cube*, by obtaining the *cube root;* the *fourth power*, by obtaining the *fourth root*, etc.

The root is indicated by the *radical sign*, with the *index* of the root over it; thus $\sqrt[3]{8}$, third root of 8; $\sqrt[4]{16}$, fourth root of 16, etc.; or, by a fractional exponent; thus $8^{\frac{1}{3}}$, third root of 8; $16^{\frac{1}{4}}$, fourth root of 16, etc. $9^{\frac{3}{2}}$ or $\sqrt{9^3}$ indicates the *square root* of the *cube* of 9, or the *cube* of the *square root* of 9. When the radical sign has no figure over it, the square root is indicated.

A *rational* root is one that can be exactly obtained.

A *surd* root is one that cannot be exactly obtained.

SQUARE ROOT.

The extraction of the square root of a number is the method of finding one of the two equal factors whose product is the number.

By examining the relations of numbers to their squares, we find that the *square* of a number contains *at least only one less* than *twice* as many figures as the number itself; and, *at most*, only *twice* as many. Thus the square of the smallest digit, $1^2 = 1$, occupies only one place, one less than twice as many as 1; and the square of the largest digit, $9^2 = 81$, occupies only two places, only twice as many as 9. So, also, is it with the square of any number of times the smallest, or largest digit, which must represent all possible numbers in this respect: $10^2 = 100$; $90^2 = 8100$; $100^2 = 10000$; $900^2 = 810000$. The number of figures in the square of 10 and of 100 is *one* less than twice as many as those numbers themselves contain; and the number of figures in the square of 90 and of 900 is only twice as many as those numbers contain. Consequently the number of figures in the root of a number will be half as many as in the number itself when that number contains an even number of figures, and when it contains an odd number of figures the root will contain *one* figure more than half the even number; thus 81, 8100, 16, and 1600 contain an even number of figures, and the root of each will contain half as many; or, will be respectively 9, 90, 4, 40; but the numbers 100, 10000, 400, 40000, etc., contain an odd number of figures, and the root of each will contain *one* more figure than half the even number. The even number of figures in 100 is 2; in 10000 is 4; in 100 is 2; and in 40000 is 4, there being an odd figure in each number. One half of the even number of figures then in these cases will be 1, 2, 1, and 2, respectively, and the roots will contain respectively *one* more figure, or will be 10, 100, 20, and 200.

Hence, to determine the *number* of figures there will be in the *square root* of a given number, divide the number into *periods of two figures each*, by placing a *dot* (or some equivalent mark) over *unit's* figure, and over *each second* figure to the *left*, if it be a *whole* number, and over *each second* figure to the *right*, if a decimal be connected; or if it be a decimal only, place a dot over *each second* figure from the decimal point. If there be not an even number of decimal places, annex a cipher to make them even. There will be as many figures in the root as there are dots over the number, because the dots indicate the number of *whole* periods and *part* period, if there be an odd number of figures; thus in the number $\dot{4}5\dot{6}8\dot{9}$, the dots show that there will be three figures in the root; and in the number $1\dot{2}3\dot{4}5\dot{6}.7\dot{8}2\dot{0}$, the dots show that there will be five figures in the root, and the decimal point shows that the two right-hand figures of the root will be decimal.

To find, numerically, the side of a square whose area is known, is equivalent to extracting the square root of the number representing the area of the square. Hence to explain the method of extracting the square root of a number, we shall make use of geometrical figures.

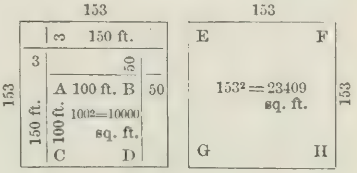
What is the length of one side of a square whose area is 234.09 square feet; or what is the square root of 234.09 ?

OPERATION.

$$
\begin{array}{rr|l}
 & \dot{2}3\dot{4}.0\dot{9} & 100 + 50 = 150 + 3 = 15.3 \\
 & & 50 \\
 & & 3 \\
 \hline
100^2 = & 100\ 00 & 15.3 \\
\text{1st divisor.} & & \\
100 \times 2 = 200 & 13409 & \\
\hline
200 \times 50 = 10000 & & \\
50 \times 50 = 2500 & & \\
12500 & 12500 & \\
\hline
\text{2d divisor.} & 909 & \\
150 \times 2 = 300 & & \\
\hline
300 \times 3 = 900 & & \\
3 \times 3 = 9 & & \\
909 & 909 & \\
\hline
 & 0 &
\end{array}
$$

Throughout the operation we shall consider the number as a *whole* number. Since our mental powers will not allow us generally to perform large calculations without noting successive processes, we cannot in this case, or generally in extracting roots, determine more than one significant figure at one time, but we can readily use ciphers in connection with that significant figure and thus approximate to the root required.

In the problem, therefore, we see from the periods that there will be three figures in the root, and we also see that the first figure cannot be larger than 1, because if it were 2 the whole root must be at least 200, and 200^2 would be 40000, a larger number than we have given. Knowing, then, that the left-hand figure of the root is 1, we, for convenience, consider for the moment that the other figures of the root are ciphers, in which case the area of the square represented would be 100 squared, or 10000 square feet.



We let the figure A B C D represent this square, whose area is 10,000 square feet, and whose side is 100 feet. By comparing this square with the one E F G H, represented by the number whose side we are to obtain, we find the latter is larger by 13,409 square feet; hence its side must be more than 100 feet.

We can see at a glance that if we add equal pieces to two sides of a square, and fill the small corner thus produced, the figure will be a larger square; and if proper additions be made to our square of 10000 feet, we shall at last obtain a square equal to that required.

We have, as we find by subtraction, 13409 square feet to add, and the addition must be made to two sides of our 100 feet square, hence must be in two pieces 100 feet each in length; therefore the length of both pieces will be two times 100 feet, or 200 feet. Since these pieces are equal to one piece 200 feet long, if we divide 13409 square feet by 200 we shall obtain the width that these pieces can be without having their square surface exceed 13409 square feet. Performing the division, we find that they can be 50 feet wide; therefore their square surface will equal 200 multiplied by 50, or the length multiplied by the width, which will be 10000 square feet. When these pieces are added to the sides of the square, we find that there is a square space to be filled in one corner in order to continue the square, which space is just the width, each way, of the pieces added to the sides, or 50 feet square; hence will require the square of 50, or 2500 square feet. Adding this piece to the two on the sides of the square, we find we have increased our square by 12500 square feet, and that it now lacks only 909 square feet of the size of the square whose side we seek. We know this by subtracting the sum of the additions, or the square feet in the three pieces, from 13409 the first remainder, or 13409 — 12500 = 909. We still have 909 square feet to add in order to make our square contain as many square feet as the one whose side is required; hence we must repeat the last process. But we have added 50 feet to the original square, and it is now 150 feet on a side, and each of the pieces added now must be 150 feet each in length, and both pieces united will be twice 150 feet, or 300 feet in length.

To find the width of these pieces we divide the number of square feet to be added, 909, by 300 the length of the pieces, and find they can be 3 feet wide, and their square surface will equal their length, 300 feet, multiplied by their width, 3 feet. Upon adding these pieces to the sides we find a corner space vacant, which is just the width each way of the last pieces added to the sides, or 3 feet square; hence will require the square of 3, or 9 square feet. Adding these three pieces together we find our square has been increased by 909 square feet, which is just the amount necessary to make it equal in surface to the square whose side we wished to know; hence its side must be the side required, or 100 + 50 + 3 = 153 feet, because we added 50 feet and 3 feet to a side of our first square, which was 100 feet on a side. Having completed our operation, we can now notice that one of the dots over the original number was above the decimal part, indicating that one figure of the root would be decimal, and we point off accordingly, obtaining for the correct result 15.3 feet as the side of the square, or 15.3 as the square root of the number.

Like principles apply to every case of the extraction of square root, no matter how large the number may be.

From this analysis of the process for the extraction of square root we deduce the following

RULE. — *Divide the number into periods of two figures each, by placing a dot over every second figure, beginning with units.*

Find the greatest square in the left-hand period for the first figure of the root, filling the other places in the root with ciphers, and place the number thus obtained at the right of the given number.

Subtract the square of the number thus representing the whole root from the number whose root is required.

Divide the remainder by 2 times the whole number representing the root, and write the quotient as a part to be added to that number in the root.

Multiply the number used as divisor by the quotient; to the product, add the square of the quotient, and subtract the sum thus obtained from the remainder which has been used as the dividend in obtaining the quotient.

Divide this remainder by 2 times the sum of the root figures thus far found, and write the quotient as a part to be added to the root.

Multiply the divisor by the quotient; to the product, add the square of the quotient, and subtract this sum from the remainder which was used as the last dividend.

Continue the process until there is no remainder, or until 2 times the sum of the root figures found will not be contained in the remainder.

What is the square root of 3444736 ?

OPERATION.

	. . . .	1000 + 800 = 1800 + 50 = 1850 + 6 = 1856
	3444736	800
$1000^2 =$	1000000	50
1st divisor.	2444736	6
1000 × 2 = 2000		1856
2000 × 800 = 1600000		
800 × 800 = 640000		
2240000	2240000	
2d divisor.		
1800 × 2 = 3600	204736	
3600 × 50 = 180000		
50 × 50 = 2500		
182500	182500	
3d divisor.		
1850 × 2 = 3700	22236	
3700 × 6 = 22200		
6 × 6 = 36		
22236	22236	
	0	

CUBE ROOT.

The extraction of the cube root of a number is the method of finding one of the three equal factors whose continued product is the number.

By examining the relations of numbers to their cubes, we find that the *cube* of a number contains, *at least*, only *two less* than *three times* as many figures as the number itself; and *at most* only *three times* as many; thus, the cube of the smallest digit, $1^3 = 1$, occupies only one place — 2 less than three times as many as 1; and the cube of the largest digit, $9^3 = 729$, occupies only three places, or three times as many as 9. The same principle applies to all numbers. Hence the number of figures in the root of a number will be one for every three figures, or triplet, of the number, and an additional one if there be a part triplet in excess; thus, in the number 14̇689̇7 there are two triplets; in 4̇689̇106̇ there are two triplets and a part triplet of one figure; in 45̇321̇ there is one triplet and a part triplet of two figures; and, as indicated by the dots over units figure and each third figure from units in each number, there will be a *root* figure for each *whole* triplet and one for each *part* triplet.

To determine, therefore, the *number* of figures there will be in the *cube root* of a given number, divide the number into *periods of three figures each* by placing a *dot* over *units* figure and over *each third* figure to the *left*, if it be a *whole* number; and over *each third* figure to the *right*, if a decimal be connected; or if it be a decimal only, place a dot over *each third* figure from the decimal point. If there be not an even number of triplets in the decimal, annex ciphers to make them even.

There will be as many figures in the root as there are dots over the number; and the number of dots over the decimal part will indicate the number of decimal places in the root; thus, in the number 456̇123̇.478̇012̇ there will be four figures in the root, two of which will be decimals.

To find numerically the length of a side of a cube whose cubical or solid contents is known is equivalent to extracting the cube root of the number representing the solid contents of the cube; hence, to explain the method of extracting the cube root of a number we make use of geometrical solids.

What is the length of one side of a cube whose contents equal 109215352 cubic inches? or what is the cube root of 109215352?

OPERATION.

```
                                   .  .  .   | 400 + 70 = 470 + 8 = 478
                                 109215352   |  70
                    400³ =        64000000   |   8
                              |-------------|-----
        1st trial divisor.    |   45215352   | 478
     400² × 3   =   480000    |
  ----------------------------|
   480000   × 70 = 33600000   |
 3 × 400 × 70² =   5880000    |
          70³ =     343000    |
                   ---------- |
                   39823000   |   39823000
        2d trial divisor.     |-----------
     470² × 3  =   662700     |    5392352
   ---------------------------|
   662700 × 8  = 5301600      |
 3 × 470 × 8² =    90240      |
          8³ =       512      |
                 -------------|
                  5392352     |    5392352
                  -------------------------
                                      0
```

As in square root, we can only determine one significant figure of the root at one time, filling the other places with ciphers, thus representing an approximate root.

In the problem we see from the periods that the root will contain three figures, and we also perceive at a glance that the left-hand figure of the root cannot be larger than 4, because if it were 5, the whole root must at least be 500, and 500^3 would be 125000000, a larger number than we have given.

Knowing, therefore, that the left-hand root figure is 4, for convenience, we consider for the moment that the other root figures are ciphers, in which case the contents of the cube would be the cube of 400, or 64000000 cubic inches, which we find by subtraction is less than the given cube by 45215352 cubic inches.

We let Fig. 1 represent the cube whose side is 400 inches. We perceive at once that, if we add equal pieces to three sides of a cube, and fill the three spaces shown in Fig. 2 and the one in Fig. 3, the figure will be a larger cube; and if the proper additions be made to our cube, whose side is 400 inches, we shall at last obtain a cube equal to the one the length of whose side we seek. The first additions must be three square pieces whose surface dimensions, as shown in Fig. 2, equal in each case the surface of the side of the cube to which they are added, and as the cube is 400 inches on a side, these pieces must each be 400 inches square, or contain 160000 square inches; consequently all three will contain three times 160000, or 480000 square inches. Since these pieces are the principal additions, we may use the number of square inches they contain, or 480000, as a trial divisor of 45215352 cubic inches — the excess necessary to be added — to ascertain how thick these three pieces can be; and we find they can be 70 inches thick. If we multiply their superficial contents, or 480000, by their thickness, 70 inches, we obtain the cubic inches in these three large pieces, or 33600000 as shown in Fig. 5. We have now to add, in order to complete the cube, three smaller pieces, whose width and thickness each equals, as shown in Fig. 3, the thickness of the large pieces, and whose length equals a side of the cube; therefore their cubic contents will each equal the product of their three dimensions, or their length, width, and thickness; and as their width and thickness are equal, we multiply the length by the square of the width, or 400 by 70^2, which product multiplied by 3 will give the solid contents of the three small pieces, or 5880000 cubic inches, as shown in Fig. 5, on next page.

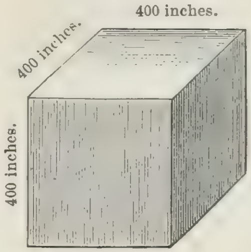


FIG. 1.

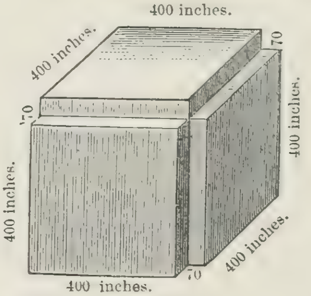


FIG. 2.

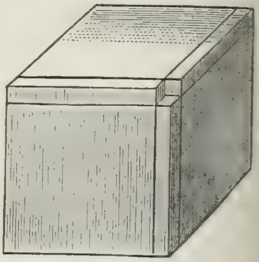
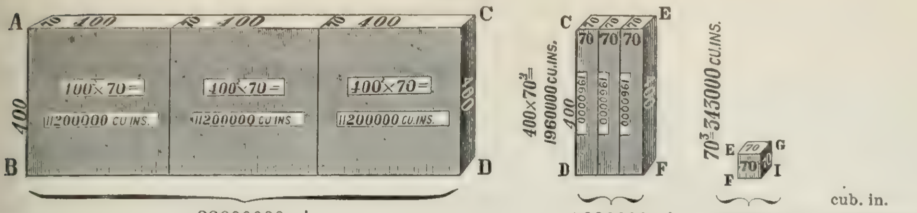


FIG. 3.

An inspection of Fig. 3 will show that there still remains a small cubical space to fill, which is 70 inches on a side; its cubic contents, therefore, will be the cube of 70, or 343000 cubic inches, as seen in Fig. 5.

The sum of the cubic contents of these seven pieces, as thus found, equals 39823000 cubic inches (see aggregate, Fig. 5), which we find, by subtraction from the 45215352 cubic inches which we had to add, leaves an excess of 5392352 cubic inches to be added to make our cube equal to the given cube.

Fig. 5.



33600000 + 5880000 + 343000 = 39823000.

A comparison of Fig. 1 with Fig. 4 will show that the pieces to be added to continue Fig. 4 a cube will be 70 inches larger each way than those added to Fig. 1. Uniting the root figures thus far found, we perceive that the large pieces now to be added will be 470 inches square, hence the square surface of the three pieces will equal three times the square of 470, or 662700 square inches, which we use for a second trial divisor to ascertain how thick these pieces may be. Dividing the excess, 5392352, by 662700, we obtain 8 inches as the thickness of these last additions, and, multiplying their superficial contents, 662700 square inches, by 8 inches, their thickness, we find their cubic contents, as shown in Fig. 6, 5301600 cubic inches.

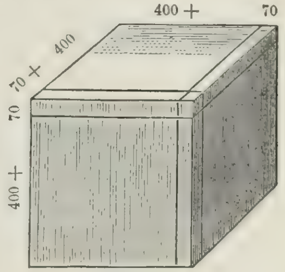
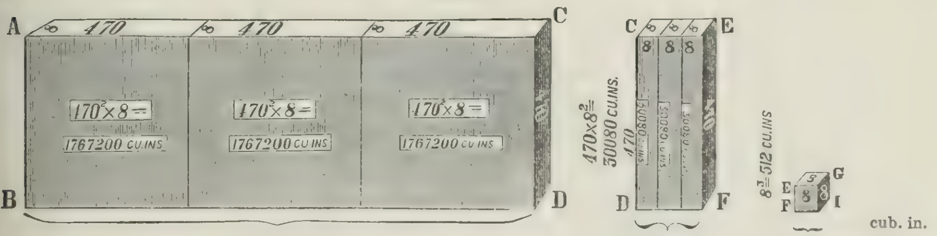


Fig. 4.

We now have three pieces to add, each of which is 8 inches square and 470 inches long, therefore each contains 470 times the square of 8, which, multiplied by 3, gives the cubic contents of these small pieces, or 90240 cubic inches. (See Fig. 6.) The little corner piece yet to be added is, in all its dimensions, equal to the thickness of the last additions, consequently contains 512 cubic inches, or the cube of 8. Uniting these seven additions in one sum, we find that it exactly equals the excess to be added; hence the cube we have formed must equal the cube whose side we required. The addition of the root figures will then give the length of the side of the given cube, which is 478 inches; or 478 is the cube root of 109215352.

Fig. 6.



5301600 + 90240 + 512 = 5392352

In Fig. 5 the three large square blocks, included by the rectangle A B C D, represent the *face* additions to the cube Fig. 1; the three rectangular blocks C D E F represent the *edge* additions; and the cubical block E F G I represents the corner addition, which completes the cube Fig. 4. The numbers on these blocks represent their dimensions and cubic contents, and the numbers beneath the blocks represent their aggregate cubic contents.

Fig. 6 represents the seven additions to Fig. 4, similar to those represented in Fig. 5 as added to Fig. 1. Like principles apply to every case of the extraction of cube root, no matter how large the number may be.

From the foregoing analysis of the process for the extraction of cube root, we deduce the following

RULE. — *Divide the number into periods of three figures each, by placing a dot over every third figure, beginning with units.*

Find by trial the greatest cube in the left-hand period for the first figure of the root, filling the other places of the root with ciphers, and place the number thus obtained at the right of the given number.

Subtract the cube of this number, thus representing the whole root, from the number whose root is required; divide the remainder by three times the square of the whole number representing the root, and write the quotient as a part to be added to that number in the root.

Multiply the number thus used as a trial divisor by the quotient obtained; to the product add the square of that quotient multiplied by three times the root figures previously found; also add the cube of that quotient, and subtract the whole sum thus obtained from the remainder used as a dividend in obtaining that quotient.

Divide this last remainder by three times the square of the sum of the root figures thus far found, and write the quotient as a part to be added to the root.

Multiply the number thus used as a second trial divisor by the quotient resulting; to the product add the square of that quotient multiplied by three times the sum of the root figures previously found; also add the cube of this last quotient, and subtract the whole sum thus obtained from the remainder used as a dividend in obtaining this last quotient. Continue the process until there is no remainder, or until three times the square of the sum of the root figures found will not be contained in the remainder.

What is the cube root of 122615327232?

OPERATION.

		1st sum. 2d sum. 3d sum.
		$4000 + 900 = 4900 + 60 = 4960 + 8 = 4968$
		900
	122615327232	60
$4000^3 =$	64000000000	8
1st trial divisor.	58615327232	4968
$4000^2 \times 3 = 48000000$		
$48000000 \times 900 = 43200000000$		
$3 \times 4000 \times 900^2 = 9720000000$		
$900^3 = 729000000$		
53649000000	53649000000	
2d trial divisor.	4966327232	
$4900^2 \times 3 = 72030000$		
$72030000 \times 60 = 4321800000$		
$3 \times 4900 \times 60^2 = 52920000$		
$60^3 = 216000$		
4374936000	4374936000	
3d trial divisor.	591391232	
$4960^2 \times 3 = 73804800$		
$73804800 \times 8 = 590438400$		
$3 \times 4960 \times 8^2 = 952320$		
$8^3 = 512$		
591391232	591391232	
	0	

APPENDIX.

When operations are merely *indicated* by the use of letters and signs, the results are called *formulæ*, or one result is a *formula;* and when these results are of general application they are called *general formulæ;* and the numerical result is obtained by substituting the numerical values of the letters and performing the operation indicated. There must always be, of course, at least one unknown term whose value is to be discovered; and in the formula, which always represents an *equality*, the unknown term is usually, for convenience, placed at the left of the sign of equality, and the indicated operation at the right of that sign.

This is, essentially, *Algebra*, as distinguished from *Arithmetic*.

When any problem is to be solved in this general manner its conditions must be considered in the same manner as in arithmetical operations, only letters and signs must be used instead of numbers. When a general formula has thus been obtained, we may, by transposition, reduction, etc., obtain a formula for any one of its terms, which we may consider unknown, if we at the same time consider all the other terms known.

The processes of change are precisely the same in principle as in the reduction of proportions and fractional equalities in arithmetic, and really involve only proper multiplications, divisions, additions, and subtractions, so made as to preserve the relative value of each term as represented by some letter.

For example, let us generalize the following problem: —

A can build a wall in 20 days; with the assistance of B he can build it in 12 days. How long would it take B to do it alone?

Let $c=20$, $d=12$, and $x=$ the time it would take B to do it.

By arithmetical analysis: If A can build it in 20 days, he could do $\frac{1}{20}$ of it in one day; and if both could do it in 12 days, they could do $\frac{1}{12}$ of it in one day. If we subtract what A alone can do in one day from what both can do in one day, we shall obtain what B can do in one day, or $\frac{1}{12}-\frac{1}{20}=\frac{1}{30}$; and if B can do $\frac{1}{30}$ of it in one day, to do $\frac{30}{30}$, or the whole of it, would take him thirty times as long as to do $\frac{1}{30}$, or thirty days.

To generalize: Substitute the letters for the numbers in the equation and we have $\frac{1}{d}-\frac{1}{c}=\frac{1}{x}$; freeing from denominators, as in common fractions, we multiply each numerator by all the denominators, except its own, and the result will be $cx-dx=dc$, or, since x is multiplied by both c and d, the equation may be expressed thus: $(c-d)x=dc$; and since x multiplied by $c-d$ equals dc, x would equal dc divided by $c-d$, or $x=\frac{dc}{c-d}$. This is the same as dividing both sides of the equation by the same number, which can always be done without destroying the equality. $x=\frac{dc}{c-d}$, then, is the general formula for problems of like character, and we may prove its correctness by substituting the numerical values of the problem in it. Then $x=\frac{12\times 20}{20-12}=\frac{240}{8}=30$ days, the same as obtained by analysis.

In any equation, as $cx-dx=dc$ or $(c-d)x=dc$, the multipliers of the unknown quantity are called the coefficients of that quantity; and we see from the analysis that the known quantity on the right of the sign of equality may always be divided, or represented as divided, by the coefficient of x or of the unknown quantity without destroying the equality; thus at the same time representing the value of the unknown quantity.

Since the addition or subtraction of the same sum from equal quantities does not destroy their equality, the removal of a part or the whole of the quantity on either side of the sign of equality to the other side, with a change of its own sign from plus to minus or from minus to plus, will not affect the equality. Thus, in the equation $cx - dx = dc$, dx is represented as taken from cx, the result being dc; but we might transpose dx to the same side of the equation as dc, and change its sign, and still preserve the equality; for it is evidently immaterial whether dx be subtracted from cx or added to dc; and in the latter case the equation would be $cx = dc + dx$. To get a formula for, or the value of, an unknown quantity, however, we unite all the terms of that quantity on the left of the equality and the terms of the known quantity on the right.

When the terms, or one of them, on opposite sides of an equation, are fractions, the expression is simply that of proportion or an equality of ratios, and as the product of the means equals the product of the extremes, these terms may be multiplied together and one result made equal to the other; or, what is the same thing, the numerator of one may be multiplied by the denominator of the other, and *vice versa*, without affecting the equality; thus, the equation $x = \frac{dc}{c-d}$ is in substance $\frac{x}{1} = \frac{dc}{c-d}$, or $x:1::dc:c-d$, or $(c-d)\,x = dc$, or $\frac{x}{dc} = \frac{1}{c-d}$, or $dc = (c-d)\,x$, or $dc = cx - dx$; or $dc + dx = cx$, or $(c+x)\,d = cx$. If we now suppose d to be *unknown* and x *known*, the equation for d will be $d = \frac{cx}{c+x}$. If we use the same values for c and x as we did above, the result of their substitution in this formula for d ought to give 12 as the value of d, or $d = \frac{20 \times 30}{20+30} = \frac{600}{50} = 12$. If we now consider c the unknown quantity, the formula for it will be obtained as follows from the first formula. $x = \frac{dc}{c-d}$, or $\frac{x}{1} = \frac{dc}{c-d}$, or $x\,(c-d) = dc$, or $cx - dx = dc$; or transposing dx and dc we have $cx - dc = dx$, or $c\,(x-d) = dx$, or $c = \frac{dx}{x-d}$. Substituting values, $c = \frac{12 \times 30}{30-12} = \frac{360}{18} = 20$, as it should.

It is by precisely similar reasoning and methods that the formulæ relating to *transverse strength*, in Physics, page 112, are obtained from the first formula; thus, $W = \frac{(bh^2)\,T}{l}$ may be written $\frac{W}{1} = \frac{(bh^2)\,T}{l}$; the latter may be treated as a common fractional equality, and since $W \div 1 = (bh^2)\,T \div l$, $W \times l = (bh^2)\,T \times 1$ or $W\,l = (bh^2)\,T$; that is, we simply free from denominators by multiplying each numerator by all denominators but its own, as in fractions. If now we consider (bh^2) the unknown quantity in the equation, as it is in the question, we may, for convenience, transpose it to the left-hand side, and at the same time put the known quantity upon the other side of the equation; but to show that this would be correct we make but one transposition at a time; thus, $W\,l$ being equal to $(bh^2)\,T$, if the latter be taken from the former nothing will remain, and the equation will be $W\,l - (bh^2)\,T = 0$, as it should. We see that in making the representation correctly we have really changed the quantity on the right of = to the left, and put the sign — (minus) before it; this has been done with the quantity on the right of the = without injuring the equality, and for the same reason it can be done with the quantity $W\,l$ on the left, and the equality continue.

It is, as before stated, the same thing as the subtraction of like quantities from like quantities, in which case the remainders are equal. The equation will now be $-(bh^2)\,T = -W\,l$; but all the terms are known except (bh^2), and since $bh^2 \times T = W\,l$, bh^2 will equal $\frac{W\,l}{T}$, which is what we wished to know, and the equation will be $-bh^2 = -\frac{W\,l}{T}$; and as the quantities on both sides of the = have like signs it is immaterial whether they are negative or positive, since a quotient is always positive if both divisor and dividend are alike, whether positive or negative. The value of bh^2 therefore is $\frac{W\,l}{T}$, and the formula is $bh^2 = \frac{W\,l}{T}$.

The value of $b\,h^2$ in each of the cases on page 113 of Physics is ascertained in like manner from the formula for W.

The formulæ for the elements of falling bodies, page 129 of Physics, are obtained by similar methods, and are combined as follows: —

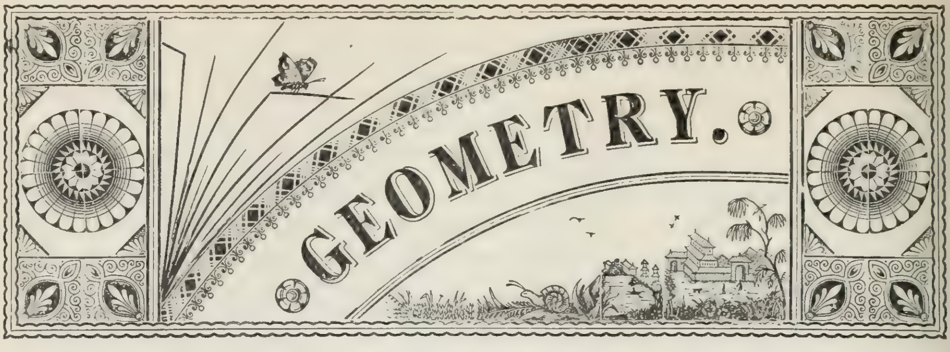
1st formula: $v = g\,t$. 2d original formula: $v = \frac{2\,s}{t}$. Having two of the values of v given, and the method of obtaining them already explained in Physics, we have to find only one other value for v, or $v = \sqrt{2\,g\,s}$; and we obtain it by combining the formulæ $v = g\,t$ and $v = \frac{2\,s}{t}$; thus by transposing the terms of the equation $v = g\,t$, we obtain $g\,t = v$; and, for the moment, considering t an unknown quantity, and g its coefficient, we obtain its value by dividing v by g, or $t = \frac{v}{g}$. Substituting this value of t in the equation $v = \frac{2\,s}{t}$, we have $v = \frac{2\,s}{\frac{v}{g}}$, or by reducing, we have $v = \frac{2\,s}{1} \times \frac{g}{v}$, or $v = \frac{2\,g\,s}{v}$, or $v^2 = 2\,g\,s$; extracting the square root of both sides of this last equation, we obtain $v = \sqrt{2\,g\,s}$, which is the third value of v desired, and the 2d in order, as shown in Physics.

To find the values of s, we first transpose the equation $v^2 = 2\,g\,s$ and obtain $2\,g\,s = v^2$. Considering s the unknown quantity, and $2\,g$ its coefficient, we obtain its value by dividing v^2 by $2\,g$, or $s = \frac{v^2}{2\,g}$, and the 1st value of s in the order shown in Physics. The 2d in order is obtained by transposition and reduction of the equation $v = \frac{2\,s}{t}$; thus, transposing, we have $\frac{2\,s}{t} = v$, or $\frac{2\,s}{t} = \frac{v}{1}$; freeing from denominators, $2\,s = t\,v$; dividing by coefficient of s, we obtain $s = \frac{t\,v}{2}$, or $\frac{1}{2}\,t\,v$. We obtain the value of s used as the 2d formula in Physics, as there indicated; *i. e.*, by the substitution of the value of v, in $v = g\,t$, in place of v in the equation $2\,s = v\,t$. The three forms, then, for the value of s are $\frac{v^2}{2\,g}$, $\frac{1}{2}\,t\,v$, and $\frac{1}{2}\,g\,t^2$.

One of the forms for the value of t has been obtained above, and is $\frac{v}{g}$ in the equation $t = \frac{v}{g}$. From the transposition of the formula $s = \frac{1}{2}\,g\,t^2$ we have $\frac{1}{2}\,g\,t^2 = s$, or $\frac{g\,t^2}{2} = \frac{s}{1}$; freeing from denominators we obtain $g\,t^2 = 2\,s$; considering g the coefficient of t^2, we obtain by division $t^2 = \frac{2\,s}{g}$, and extracting the root of both sides of this last equation the result is $t = \sqrt{\frac{2\,s}{g}}$, the second form of the value of t. From the reduction of the equation $v = \frac{2\,s}{t}$ we obtain $\frac{v}{1} = \frac{2\,s}{t}$, or $v\,t = 2\,s$; and considering v the coefficient of t, $t = \frac{2\,s}{v}$, the third form of the value of t.

The three forms for the value of t are therefore $\frac{v}{g}$, $\sqrt{\frac{2\,s}{g}}$, and $\frac{2\,s}{v}$.

From the transposition of the equation $v = g\,t$ we have $g\,t = v$, and considering t the coefficient of g, we obtain by division $g = \frac{v}{t}$, the first form of the value of g. By transposition of the equation $s = \frac{1}{2}\,g\,t^2$ we obtain $\frac{1}{2}\,g\,t^2 = s$, or $\frac{g\,t^2}{2} = \frac{s}{1}$; freeing from denominators, the result is $g\,t^2 = 2\,s$, and considering t^2 the coefficient of g, we obtain by dividing $g = \frac{2\,s}{t^2}$, second form of the value of t. From the equation $v = \sqrt{2\,g\,s}$ we obtain, by squaring both sides, $v^2 = 2\,g\,s$; transposing, we have $2\,g\,s = v^2$, and considering $2\,s$ the coefficient of g, we obtain by dividing $g = \frac{v^2}{2\,s}$. The forms for g are $\frac{v}{t}$, $\frac{2\,s}{t^2}$, and $\frac{v^2}{2\,s}$.



GEOMETRY.

DEFINITIONS.

A *point* has position but not magnitude.

A *line* has only length.

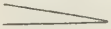
A *straight or right line* is the shortest distance between two points.

A *curved line* changes its direction at every point.

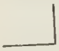
A *surface* has length and breadth only.

A *solid* has length, breadth, and thickness.

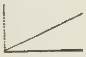
An *angle* is the measure of the difference of direction of two lines which begin, actually or virtually, at the same point.



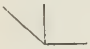
The *vertex* of an angle is the point from which its sides start.



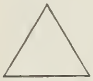
A *right angle* is formed by two lines perpendicular to each other.



An *acute angle* is less than a right angle.



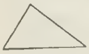
An *obtuse angle* is greater than a right angle.



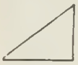
A *triangle* is a surface bounded by three sides.

An *equilateral triangle* has all its sides equal.

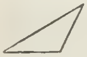
An *isosceles triangle* has two sides equal.



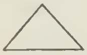
A *scalene triangle* has all sides unequal.



A *right-angled triangle* has a right angle.



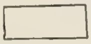
An *obtuse-angled triangle* has an obtuse angle.



An *acute-angled triangle* has all its angles acute.

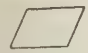
A *quadrangle* or *quadrilateral* is a figure bounded by four sides, and has the following forms: —

A *parallelogram*, having opposite sides parallel.

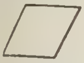


A *rectangle*, a parallelogram having right angles.

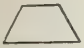
A *square*, an equilateral rectangle.



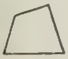
A *rhomboid*, a parallelogram with no right angles.



A *rhombus*, an equilateral rhomboid.



A *trapezoid*, having only two sides parallel.

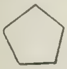


A *trapezium*, with no two sides parallel.

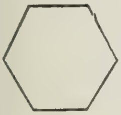
A *triangle* is sometimes called a *trigon*, and a *square*, a *tetragon*.

Polygons are plane figures of three or more sides. Their boundary line is called a *perimeter*.

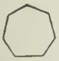
Polygons are regular when their sides and angles are equal, otherwise irregular, and are named from the number of their sides, as follows: —



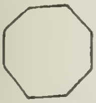
A *pentagon* has five sides.



A *hexagon* has six sides.

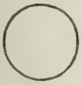


A *heptagon* has seven sides.

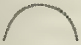


An *octagon* has eight sides.

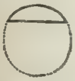
A *nonagon* has nine sides.
A *decagon* has ten sides.
An *undecagon* has eleven sides.
A *dodecagon* has twelve sides.



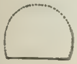
A *circle* is a plane figure bounded by a curved line called a circumference or periphery, which is everywhere equally distant from a point within called the centre.



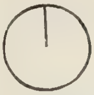
An *arc* is any part of a circumference.



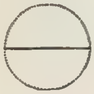
A *chord* is a right line joining the extremities of an arc.



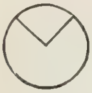
A *segment* of a circle is any part of the circle bounded by an arc and its chord, or included between two parallel chords.



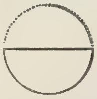
The *radius* is a straight line extending from the centre to the circumference (plural, *radii*).



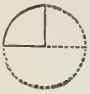
A *diameter* is a straight line drawn through the centre of a circle and terminated on either side by the circumference.



A *sector* is any part of a circle bounded by an arc and radii drawn to its extremities.



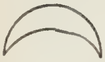
A *semicircle* is half a circle.



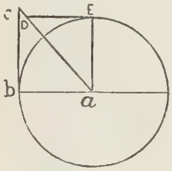
A *quadrant* is a quarter of a circle.

A *zone* is that part of the *surface* of a sphere cut off by a plane, or included between two parallel cutting planes.

A *spherical segment* is the portion of a sphere cut off by a plane, or included between two parallel cutting planes.



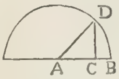
A *lune* is the portion of the surface of a sphere included between two semicircumferences of great circles.



A *secant* is a radius extended to meet a tangent (*a c*).

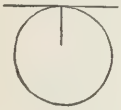
A *cosecant* is a secant of the complement of an arc (*a d*).

A *sine* is a straight line let fall from the extremity of an arc, perpendicularly to a radius drawn to the other extremity (D C).



A *cosine* is that part of the radius between the centre and the foot of the sine (A C).

A *versed sine* is that part of the radius between the foot of the sine and the circumference (C B).



A *tangent* is a line drawn perpendicularly to a radius at the circumference.

A *cotangent* is a tangent of the complement of an arc.

The *circumference* of every circle is supposed to be divided into three hundred and sixty equal parts called degrees; each degree into sixty minutes, and each minute into sixty seconds.

The complement of an angle is what remains after subtracting the angle from 90°.

The supplement of an angle is what remains after subtracting the angle from 180°.

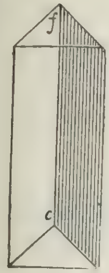
A prism is a solid whose bases are equal and parallel polygons, and whose lateral faces are parallelograms; its bases may be triangular, square, or hexagonal, etc.

A parallelopipedon is a solid bounded by six parallelograms.

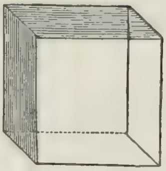
A pyramid is a solid whose base is rectilinear and its sides triangles, terminating in a point called the *vertex*.

A cylinder is a solid formed by the rotation of a rectangle about one of its sides, which is called the *axis*.

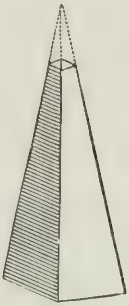
A sphere is a solid bounded by a surface, every point of which is equally distant from a point within called the *centre*.



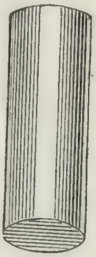
Prism.



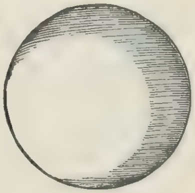
Parallelopipedon.



Pyramid.



Cylinder.

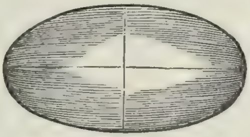


Sphere.

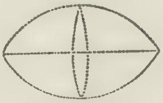
The altitude or height of a figure is the length of a perpendicular let fall from its vertex to its base.

The measure of an angle is the number of degrees in the arc cut by the two sides of the angle.

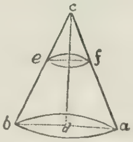
A prismoid has its ends parallel, but its sides are trapezoids.



Spheroid.



Spindle.



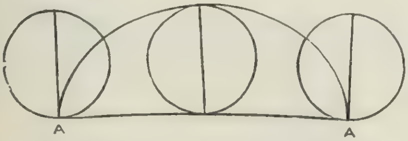
Frustum of a Cone.

A spheroid is a solid described by the revolution of an ellipse about one of its axes.

A spindle is a solid formed by the revolution of a curve around its chord.

A segment of a cone is the part, *c e f*, cut off by a plane parallel to the base.

A frustum of a cone is the part, *a f e b*, remaining after a segment is cut off.



A cycloid is the curve formed by a point of the circumference of a circle in one revolution along a right line A A.

An epicycloid is the curve formed by a point of the circumference of a circle in one revolution on the circumference of another circle.

An ungula is the bottom part of a cone or cylinder cut off by a plane passed obliquely through its base.

GEOMETRICAL PROBLEMS, OR MENSURATION.

To find the area of any figure having four parallel sides: Multiply the length by the altitude.

The area of a triangle is one half the product of base and altitude.

The area of a trapezium is equal to half the product of a diagonal and perpendiculars from opposite angles to the diagonal.

The area of a trapezoid is equal to half the product of the sum of its parallel sides multiplied by the perpendicular distance between them.

The area of any regular polygon is equal to the product of half the perimeter multiplied by the perpendicular distance from its centre to one of its sides.

To find the area of an irregular figure: Divide it into trapeziums and triangles; find the area of each separately, and add them.

The circumference of a circle is 3.1416 times its diameter.

The area of a circle is equal to the square of the radius multiplied by 3.1416; or half the diameter multiplied by half the circumference.

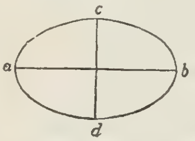
The area of a sector is equal to half the product of its arc and radius.

To find the area of a segment of a circle less than a semicircle: Find the area of a sector having the same arc, and subtract from it the area of the triangle composed of the two radii and the chord.

To find the area of a segment of a circle greater than a semicircle: Find the area of the lesser segment, and subtract it from the area of the circle; or divide into three parts by radii drawn to the extremities and middle of the arc, and find each part separately.

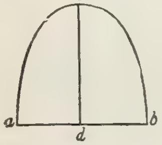
To find the area of a segment of a circle when the segment is included between parallel chords: Subtract the areas of the segments on each side from the area of the circle.

To find the convex surface of a segment or zone of a sphere: Multiply its height by the circumference of the sphere.

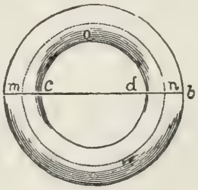


To find the circumference of an ellipse: Square its axes $a\,b$ and $c\,d$, and multiply the square root of half their sum by 3.1416.

The area of an ellipse is equal to the product of its axes $a\,b$ and $c\,d$ multiplied by .7854.

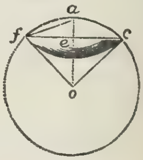


Parabola.



Cylindrical Ring.

Frustum of a Right Cone.



Spindle.

The area of a parabola is equal to two thirds the product of its base $a\,b$ and altitude $e\,d$.

To find the convex surface of a cylindrical ring: Multiply the sum of the thickness of the ring and its inner diameter, $b\,d + c\,d$, by its thickness $b\,d$, and the product by 9.8696.

The area of a circular ring is equal to the area of the outer circle minus the area of the inner circle.

The area of a lune is found by joining its extremities by a straight line, and subtracting the area of the inner segment from the outer.

The convex surface of a cylinder is equal to the product of its length and circumference.

The surface of a cone or pyramid is equal to the product of the perimeter or circumference of the base multiplied by half the slant height, plus the area of the base.

The convex surface of a frustum of a right cone or pyramid is the product of the sum of the circumferences or perimeters of the two ends *e f* and *a b* multiplied by half the slant height *b f*, plus the area of the two ends *e f* and *a b*.

The convex surface of a sphere is equal to the product of its diameter and circumference.

To find the convex surface of a spindle: Multiply the length *f c* of the spindle by the radius *o c* of the revolving arc; multiply the arc *f a c* by the distance *a e* between the centre of the spindle and the centre of the arc. Subtract the last product from the former, double the remainder, multiply it by 3.1416, and the product is the surface.

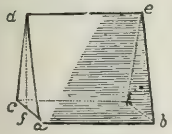
The contents of a cube is equal to the cube of one side.

The contents of any parallelopipedon is the product of the length, breath, and depth.

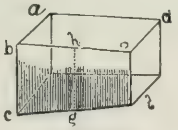
The contents of cylinders, prisms, etc., is the product of the area of the base multiplied by the height.

The contents of a cone or pyramid is one third the product of the area of the base and altitude.

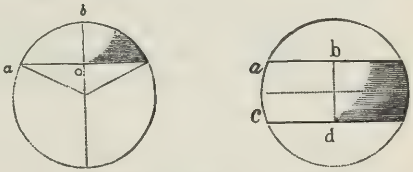
The contents of the frustum of a pyramid or of a cone is found by adding the areas of the two ends and the square root of their product, and multiplying this sum by one third the altitude.



Wedge.



Prismoid.



Spherical Segments and Zones.

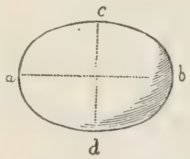
To find the contents of a wedge: Add to its length *d e* twice the length of its back *a b*; multiply this sum by the height *d f*, and then by the breadth of the back *c a*, and divide by 6.

To find the contents of a prismoid: Add the areas of the two ends *a b c*, *d e f*, and four times the middle section *g h*, parallel to them, and multiply this sum by one sixth the height.

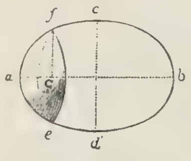
The contents of a sphere is equal to the cube of its diameter multiplied by .5236.

To find the contents of a spherical segment: Add the square of its height *o b* to three times the square of the radius of its base *a o*; multiply this sum by the height, and the product by .5236.

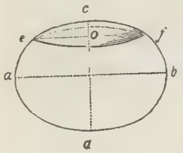
To find the contents of a spherical segment having two bases: Add to the sum of the squares of the radius of each end, *a b*, *c d*, one third of the square of the height *b d* of the zone; multiply this sum by the height, and the product by 1.5708.



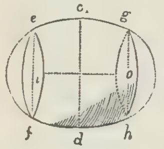
To find the contents of a spheroid: Multiply the square of the revolving axis *c d* or *a b* by the fixed axis *a b* or *c d*, and the product by .5236.



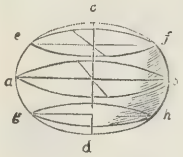
To find the contents of the segment of a spheroid: When the base *e f* is circular, or parallel to the revolving axis *c d*, multiply the fixed axis *a b* by 3, and the height of the segment *a g* by 2, and subtract the one product from the other; then multiply the remainder by the square of the height of the segment, and the product by .5236. Then, as the square of the fixed axis is to the square of the revolving axis, so is the last product to the contents of the segment.



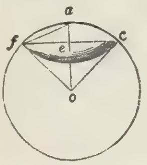
When the base *e f* is perpendicular to the revolving axis *c d*, multiply the revolving axis by 3, and the height of the segment *o g* by 2, and subtract one from the other; then multiply the remainder by the square of the height of the segment, and the product by .5236. Then, as the revolving axis is to the fixed axis, so is the last product to the contents.



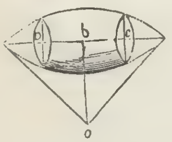
To find the contents of the middle frustum of a spheroid: 1. When the ends *e f* and *g h* are circular, or parallel to the revolving axis *c d*: To twice the square of the revolving axis *c d* add the square of the diameter of either end, *e f* or *g h*; then multiply this sum by the length *i o* of the frustum, and the product again by .2618.



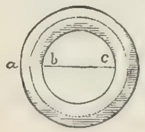
2. When the ends *e f* and *g h* are elliptical, or perpendicular to the revolving axis *c d*: To twice the product of the transverse and conjugate diameters of the middle section *a b* add the product of the transverse and conjugate width of either end; multiply this sum by the length of the frustum, and the product by .2618.



To find the contents of a circular spindle: Multiply the central distance *o e* by half the area of the revolving segment *a c e f*; subtract the product from one third of the cube of half the length *f c*, then multiply the remainder by 12.5664 (4 × 3.1416).



To find the contents of the frustum or zone of a circular spindle: From the square of half the length of the whole spindle take one third of the square of half the length *d b* of the frustum; multiply the central distance *o b* by the revolving area which generates the frustum; subtract the latter product from the former, and the remainder multiply by 6.2832 (2 × 3.1416).



To find the contents of a cylindrical ring: To the thickness of the ring *a b* add the inner diameter *b c*; then multiply the sum by the square of the thickness, and the product by 2.4674.

To compute the volume of an irregular body: Weigh it both in and out of fresh water, and note the difference in pounds; then, as 62.5 lbs.* is to this difference, so is 1,728 † to the number of cubic inches in the body. Or divide the difference in pounds by 62.5, and the quotient will give the volume in cubic feet.

Note. — If salt water is to be used, the ascertained weight of a cubit foot of it, or 64 lbs., is to be used for 62.5.

Example. — An irregular-shaped body weighs 15 pounds in water, and 30 out: what is its volume in cubic inches?

$30 - 15 = 15 =$ *difference of weights in and out of water.*

$62.5 : 15 :: 1{,}728 : 414.72 =$ *volume in cubic inches.*

Or, $15 \div 62.5 = .24$, and $.24 \times 1{,}728 = 414.72 =$ *volume in cubic inches.*

TRIGONOMETRY.

AS in geometry, so in trigonometry, with three parts of a triangle given, providing one of them is a side, the other parts may be found. To effect this, however, it is necessary to know the natural or logarithmic sines, tangents, etc., of the angles. The definitions of these terms have been given in the preceding pages. We have not space to show analytically how the numerical values of these are obtained, and can only indicate geometrically the numerical ratios of the respective parts of a right-angled triangle drawn in a semicircle whose radius is assumed as *unity.*

An angle at the centre of a circle is proportional to the arc of the circumference intercepted between the radii which form the angle, hence proportional to the various parts of the right triangle formed by the radii and the perpendicular to one of them from one extremity of the arc.

Since every oblique triangle is resolvable into two right triangles by a perpendicular from one of the angles to the opposite side, the solution of all triangles may be made to depend upon that of right triangles.

By extending the sides of either of the oblique angles of a right triangle, any number of right triangles of different dimensions may be obtained without effecting a change of angles; but if one oblique angle be changed, the other will necessarily be changed.

The ratios, then, of the sides of any right triangle depend alone upon the value of the angle opposite the perpendicular.

The *sine* of this angle is the perpendicular opposite it in a circle whose radius is unity, and its numerical value may be found in a table of sines and cosines.

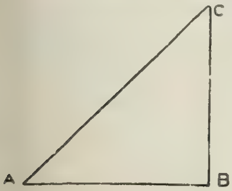


Fig. 1.

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[*] The weight of a cubic foot of fresh water.

[†] The number of inches in a cubic foot.

In any right triangle, as A B C (Fig. 1),

The SINE *of an acute angle is the quotient obtained by dividing the opposite side by the hypothenuse.*

$$\text{Thus, sin. A} = \frac{BC}{AC}, \text{ sin. C} = \frac{AB}{AC}.$$

The TANGENT *is the quotient obtained by dividing the opposite side by the adjacent side.*

$$\text{Thus, tan. A} = \frac{BC}{AB}, \text{ tan. C} = \frac{AB}{BC}.$$

The SECANT *is the quotient obtained by dividing the hypothenuse by the adjacent side.*

$$\text{Thus, sec. A} = \frac{AC}{AB}, \text{ sec. C} = \frac{AC}{BC}.$$

The cosine, cotangent, and cosecant of an angle being respectively the sine, tangent, and secant of the complement of that angle, the sine of A will be the cosine of C; the tangent of A, the cotangent of C; and the secant of A, the cosecant of C, — and *vice versa.*

Thus, sin. A and cos. C each equal $\frac{BC}{AC}$.
" C " " A " " $\frac{AB}{AC}$.
tan. A " cot. C " " $\frac{BC}{AB}$.
" C " " A " " $\frac{AB}{BC}$.
sec. A " cosec. C " " $\frac{AC}{AB}$.
" C " " A " " $\frac{AC}{BC}$.

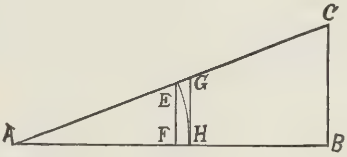


FIG. 2.

In utilizing these various representatives of angles in right triangles, we may explain the process of solution by similarity of triangles (Fig. 2), in which A E F represents the tabular triangle whose hypothenuse equals unity, the radius of a tabular circle.

We wish to find three parts of the triangle A B C, when three of them, one being a side, are given.

From the geometrical principle of similar triangles we have the proportions,

A E : E F :: A C : B C, or from the trigonometrical relations,

$$\text{Radius} : \text{sin. A} :: AC : BC, \text{ or } \frac{\text{sin. A} \times AC}{\text{Radius}} = BC.$$

EXAMPLE. — In a triangle right-angled at B, given the hypothenuse A C, 200 feet, and the acute angle A, 31°, to find the perpendicular.

In the formula or proportion above given substitute the values in the example: —

$$\text{Radius} = 1 : \text{sin. } 31^\circ = .51504 :: 200 : 103.008 \text{ feet.}$$

To find the base A B, the proportion is —

A E : A F :: A C : A B, or

$$\text{Radius} : \text{cos. A} :: AC : AB, \text{ or } \frac{\text{cos. A} \times AC}{\text{Radius}} = AB.$$

Substituting values in example, we have:—

Radius = 1 : cos. A = .85717 :: 200 : 171.434 feet.

To find the angle C, subtract the angle A from 90°; or 90° — 31° = 59° = Angle C.

In every right triangle, the two acute angles together equal one right angle, or 90°.

In the above figure, G H represents the tabular tangent of the angle A; and A G is the secant of A.

To find the perpendicular B C, when the base A B, 500 feet, and the angle A, 32°, are given:—

A E : G H :: A B : B C, or Radius: tan. A :: A B : B C, or
1 : tan. A = .62487 :: 500 : 312.435 feet.

To find the angle A, when the base A B, 563 feet, and the perpendicular B C, 547.932 feet, are given:—

A B : B C :: Radius: tan. A, or
653 : 547.932 :: 1 : .83910, or tan. A.

This number in the table of tangents is found to represent 40°, and this is the angle sought.

The secants may be used thus:—

A H : A G :: A B : A C, or Radius: sec. A :: A B : A C.
And A G : A H :: A C : A B, or sec. A: Radius :: A C :: A B.

In any triangle, right or oblique, the sines of the angles are to each other as the sides opposite these angles.

Thus, in the triangle A B C, Fig. 3, the sine of A is to the sine of C as the side B C is to the side A B, or

$$\text{Sin. A} : \text{sin. C} :: \text{BC} : \text{AB, or } \frac{\text{sin. C} \times \text{BC}}{\text{sin. A}} = \text{AB}.$$

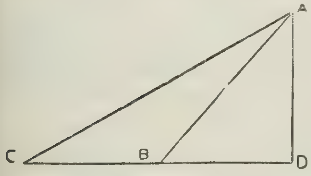


Fig. 3.

To find the angle C, when the angle A and the sides B C and A B are given.

$$\text{BC} : \text{AB} :: \text{sin. A} : \text{sin. C, or } \frac{\text{AB} \times \text{sin. A}}{\text{BC}} = \text{sin. C}.$$

The proportions and formulæ are as applicable to the use of logarithmic as natural sines, etc.; only if the former are used, addition must take the place of multiplication, and subtraction the place of division.

These principles are put to practical use in various ways, as finding the heights of inaccessible places, the distance to distant objects, etc. For instance, if we wish to determine the height of the tower A D (Fig. 4), we lay off from the base of the tower a convenient base line B D, and with an instrument for measuring angles, called a quadrant, find the angle A B D. Subtracting this from 90°, we obtain the angle A; for the angle D is a right angle. With these angles and the base line we solve our problem by use of the proportion—

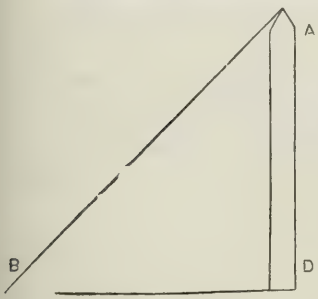


Fig. 4.

Sin. A : sin. B :: B D : A D;

or we can use the proportion—

Radius : tan. B :: B D : A D.

If we wish to determine the distance between objects on opposite sides of a river, as A and B in Fig. 5, we measure off from A a base line A C, and with a quadrant measure angles C and A. Then, as the three angles in every triangle together equal 180°, we add A and C and subtract the sum from 180°, and thus obtain the angle B; then use the proportion —

Sin. B : sin. C :: A C : A B.

To find the distance of a heavenly body approximately, as the sun: —

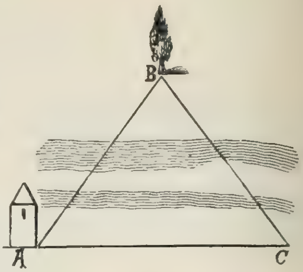


Fig. 5.

Knowing the semidiameter of the earth, we take it for a base line H C (Fig. 6); S being the position of the sun, considered as in a plane tangent to the surface at H. The angle H S C is called the *horizontal parallax*, and is found by observation, and in case of the sun by the passage of the planet Venus across its disc. In the right triangle thus constructed, we have the proportion —

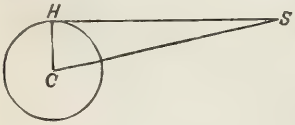


Fig. 6.

Sin. S : Radius :: H C or semidiameter of earth : C S,

the distance of the sun from the earth's centre. Subtract the semidiameter of the earth, and we have the distance from the surface of the earth to the surface of the sun.

To find the diameter of the earth, using the height of a mountain above sea level as a base line: —

Let A B in the vertical line A F be the height of the mountain, and let A E be a tangent line drawn from the summit A of the mountain to the most distant visible point of the ocean's surface. From the sea level base B of the mountain consider a line perpendicular to A F drawn to the tangent A E at C; then C B will equal C E. Measure the angle E A B, and in the triangle A C B we shall have the perpendicular A B, and the angles at A and B given to find the hypothenuse A C and the base B C. Since the angle B is a right angle, the angle C may be found by subtracting the angle E A B from 90°; then to find C B the proportion will be: —

Sin. C : sin. A : : A B : B C;

and to find A C the proportion will be: —

Cos. C : R : : B C : A C.

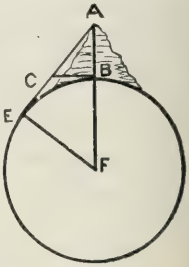


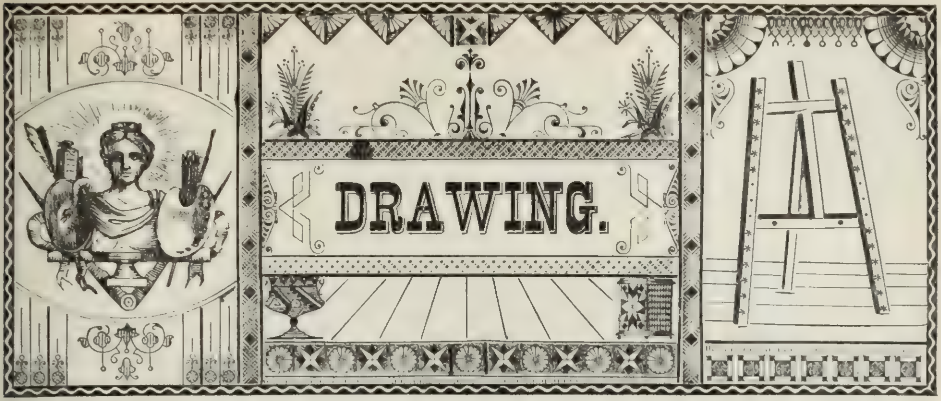
Fig. 7.

As C E equals B C, E A will equal B C + A C; hence, in the right triangle A E F, the angles at A and E, and the side A E are known, with which to find E F. We obtain the angle F by subtracting the angle A from 90°, and the proportion —

Sin. F : Sin. A : : A E : E F

will give the semidiameter of the earth E F. Of course double this result will be the earth's diameter.

The solution of triangles as herein described is applicable to surveying, navigation, and engineering; though for determination of the relative positions of large areas of the earth's surface, spherical trigonometry is necessary.



DRAWING.

It is commonly believed that in order to successfully practise the *art of drawing* or of *painting*, a man should devote his whole time to the study. There is some truth in this, of course: fine paintings are the results only of the lifelong study of great artists, and few persons may hope to produce them. But to be able to draw and express one's ideas through the sympathetic medium of form and color is the desire of almost every intelligent being; and this power may be acquired by any person endowed with ordinary intellectual faculties, without interfering with his every-day pursuits.

By employing his leisure hours in the study of this beautiful art, a man may gradually acquire a more comprehensive and appreciative perception of beauty, and see what hosts of beautiful things have hitherto been unnoticed by him. His perceptive faculties become sharpened, and nature presents to him new and more interesting phases.

It matters not what a man's vocation may be: if he has the taste to discern and mind to esteem the good and beautiful in nature and art, an expression of refinement will be manifest in all that he undertakes.

It is a duty, and would soon become a pleasure, for such a person to cultivate this higher element of his being. Many a mechanic possesses natural powers superior to the man who now plans his work, and might become the master instead of the servant if he would direct his attention, in leisure hours, to the study of the mechanical principles involved in his particular trade; and a knowledge of the principles of freehand and mechanical drawing would be useful to every mechanic, and can be acquired by any man of ordinary capacity if he wills it.

In all branches of trade, the ability to illustrate by a little sketch the exact idea which one desires to convey will often save mistakes, especially where it is difficult to express clearly in words what is required. For instance, a little plan of a box with the dimensions marked on it will give a better idea of the thing wanted than any description in words only, and will take much less time if the man who orders it can draw it. So, too, an idea in regard to a casting or some ornamental work, as a monument, can be thus clearly and easily expressed. In fact, *there is nothing to hinder the mechanic*, except the will and application to this and other kindred branches of study, *from becoming his own draughtsman*, *architect*, *or designer*, or from fitting himself to follow these vocations.

Mechanical Drawing.

Good instruments are necessary, and with proper care will last a lifetime. A drawing board, with sides perfectly true and at right angles, is the first requisite and should be made so as not to warp. A T square, a straight-edge ruler, triangles, one or two ruling pens, two pairs of compasses with adjustable pens and pencils for drawing circles, a pair of dividers, a pair of proportional dividers, a protractor, and also a sector, are needed. The paper may be fastened upon the drawing board either with thumb tacks or by pasting the edges. For the method of doing this, see page 98. With the T square you can draw any number of parallel lines, and, by turning the board, any number of right angles with them.

Have a hard lead-pencil trimmed neatly to a point, with which to make dots and to outline before inking whatever you are drawing; because at first you will be apt to make mistakes, which are easily erased when made with a pencil instead of ink. India ink is the best, as it does not corrode the pen and is jet black. Mix with a few drops of water, in a small saucer, only a sufficient quantity of the ink for immediate use, as it dries rapidly.

The ruling pen is filled from an ordinary pen, and should be cleaned after using, before being put away, by sliding a piece of soft paper between the points, taking care not to bend them. The pen should be tried before using, on a separate piece of paper, and the line adjusted to the right width by the screw at the side. You should have some clean paper to lay over your drawing where your hand rests, so as to keep it clean. When a number of lines are to be drawn to one point, it will be easier if a needle is stuck in the point to guide the ruler.

The two triangles should be both right-angled: one with two angles 60° and 30° respectively, and the other with each acute angle measuring 45°.

By means of these triangles and the T square, a great variety of figures can be drawn. The compass is used for circles. The leg used as a centre has a needle point, which is apt, if many circles are to be drawn from the same centre, to wear a hole; in which case what is called a horn centre may be used to advantage, and costs but little. A pair of dividers is used to measure distances, especially intervals that are repeated. Care should be taken not to make the dots too deep, lest they show after the lines are inked. The *rectangular protractor* has scales for reducing to any degree according to various proportions, and for determining all angles. A *scale of equal parts* is used for minute measurements. The divisions will be understood by referring to Fig. 1. B C is one tenth of the line C D; the space between B A and C A one space from A is one tenth of B C, two spaces two tenths, and so on; and one tenth of B C will be one hundredth of C D.

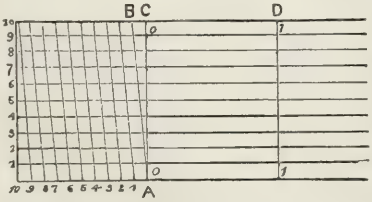


Fig. 1.

Proportional dividers can be set so that measurements at one end can be reduced or increased, as may be desired, in due proportion at the other end, up to a certain limit.

The *sector* has various scales; the principal being those marked L, P O L, and C. It consists of two strips of ivory with a hinge like that of dividers. Measurements lengthwise are lateral, across are transverse.

L is the line of lines divided into ten primary divisions, each of which is divided into ten secondary parts. Suppose we wish to divide a line three and a half inches long into nine equal parts: we open the sector until from 9 to 9 transversely is equal to three and a half inches, measuring it with the points of dividers; then upon the line to be divided we set off the distance from one end equal to the transverse measurements from 8 to 8, 7 to 7, 6 to 6, etc., and the line will be divided as desired.

To find, for example, eighty-four hundredths of a line three inches long: open the sector so that the distance between the two 10s is three inches; measure with the dividers the distance between the fourth divisions from the 8s, and it will be the required eighty-four hundredths. To find seventy-one ninety-fifths of a line two inches long: separate the sector till the distance between the fifth divisions from the 9s is two inches, then measure the distance between the first divisions from the 7s, and it will be the required seventy-one ninety-fifths.

As to the lines marked P O L, they are for determining measurements which will go an even number of times around a circle. The radius will go six times around its circumference, from which can be inscribed a polygon of six sides. If then you open the sector until the 6s are just the length of the radius apart, the distances between the 4s, 5s, 6s, 7s, 8s, etc., will go four, five, six, seven, eight, etc., times around the circumference whose radius you use. If you wish to construct an octagon with sides an inch long, open the sector until the 8s are an inch apart, then the distance between the 6s will be the radius of the circle, whose circumference you can divide into eight equal divisions of an inch, and join the points for the octagon. The line marked C (line of chords) is for obtaining angles and chords. Draw one side of your angle, and from the point which is to be the vertex of the angle, with any radius, describe an arc intersecting the line; then open the sector until the radius you used will measure the distance between the 60s; then find the distance between the numbers that indicate the angle you require, and lay it off upon your arc from its intersection with the line; join the point thus determined with the vertex, and you will have the required angle.

Water colors are used for coloring certain parts of drawings, and the best should be selected, as they are more satisfactory in working. They are used like the India ink, and laid on with a camel's-hair or sable brushes. Brickwork, in plan, is tinted with crimson lake, and in elevation a little yellow is added. Stone may be either pale gray or pale brown. Wood-work is painted with yellow ochre, and has the section lines marked with burnt sienna. Concrete is expressed by dark mottled gray. Slates are either purple or green laid on thin. Iron is colored with indigo, brass with gamboge, and copper with an orange composed of gamboge and crimson lake. In plans of estates, grass is a green compound of gamboge and Prussian blue. Water is colored blue alone, and earth with raw sienna.

PROBLEMS IN MECHANICAL DRAWING.

To inscribe any right-lined figure of equal sides in a circle, it is only necessary to divide the circumference into as many equal divisions as there are sides, and join the points obtained; and to circumscribe any figure, draw tangents to the points obtained, producing them until they intersect. The radius of a circle will go six times around its circumference, and form an inscribed hexagon. By joining the alternate points of a hexagon, we will have an inscribed triangle. Two diameters at right angles, with their extremities joined, will form an inscribed square; and bisecting the arcs thus formed by radii drawn perpendicularly to the sides of the square, we will have eight divisions from which to form an octagon.

To inscribe a circle in any equilateral figure: Bisect the sides by perpendiculars, and the point of intersection within will be the centre of the circle which can be described with a radius equal to the perpendicular distance from the centre to one of the sides.

To describe an ellipse or oval: Let *a b* (Fig. 2) be the length of proposed ellipse, and *c d* half its breadth; bisect *a b* in *c*, draw *c d* perpendicular to it; with *a c*, from *d*, cut *a b* in *e* and *f*; in *d*, *e*, *f* fix pins; fasten a cord round *e*, carry it round *d*, and fasten it firmly to *f*; take out the pin *d* and substitute for it a pencil or tracer; keep the cord tight, and from *d* toward *a* move the tracer, and from *d* to *b*; half of the ellipse will be described; move the cord to the other side of the pins for the remaining half.

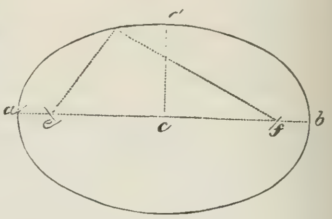


FIG. 2.

Arches may be described with part of a circle or ellipse.

A pointed arch may be described by arcs drawn from the extremities of the base of an equilateral triangle to its vertex, with a radius equal to one side.

To describe a lancet arch (Fig. 3): Draw c *h*, *f d* at right angles. Let *a b* be the breadth, and divide it into three equal parts; lay four of these from *a b* to *h*; from *a b*, with *a b*, lay to *d* and *f*; from these as centres, with radius *d b*, *f a*, describe arcs cutting in *h*; *o*, *o* are centres from which the dotted arcs are put in.

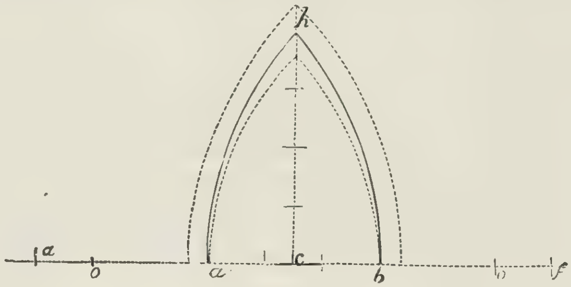


FIG. 3.

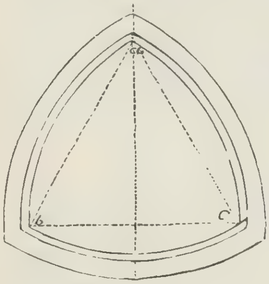


FIG. 4.

To describe the arched window opening (Fig. 4): Describe an equilateral triangle *a b* c, and *a*, *b*, c are the points from which the arcs are described.

To describe the internal tracery in Fig. 5: Draw, as before, the equilateral triangle and the outline curve; bisect *a* c, *b* c, *a b*, in the points *f*, *g*, *e*; from the point *e*, with radius *a e*, describe arcs to *m*, *n*, from *a* and *b*; also from *f* and *g*, with same radius, other arcs from *a*, *b*, and c meeting in *n*, *m*, and *o*.

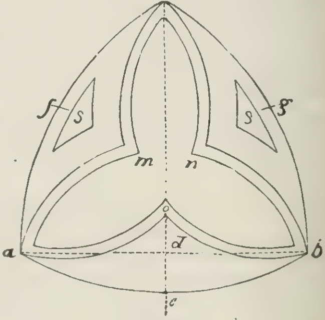


FIG. 5.

The Figures 6 and 7 show arches made from circles, described in Fig. 6 from *a b* c of an equilateral triangle; and in Fig. 7 from *m*, the vertex of a triangle whose sides are equal to *a b*, and *a*, *b*, *c*, *d* of the square used as centres.

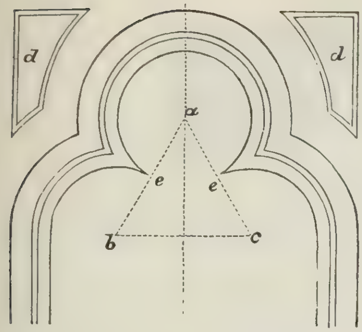


FIG. 6.

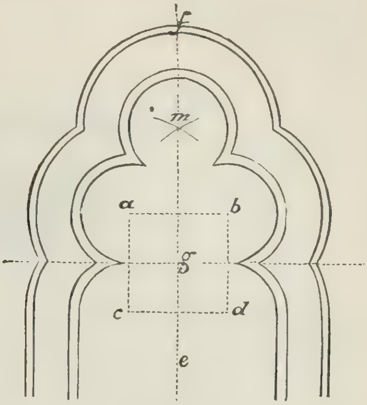


FIG. 7.

ROMAN MOULDINGS are composed of straight lines and arcs of circles.

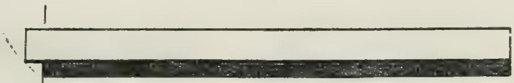


FIG. 8. — Fillet.

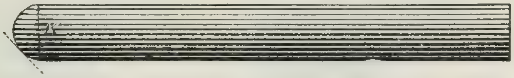


FIG. 9. — Bead.

A fillet, band, or listel (Fig. 8) is a raised square member, with its face parallel to the surface on which it is placed.

A bead (Fig. 9) is a moulding whose surface is a semicircle struck from the centre K.

The torus (Fig. 10) is composed of a semicircle and a fillet. The projection of the circle beyond the fillet is equal to the radius of the circle; the curved dotted line above and the square dotted line below show the position of those members when used as the base of a Doric column.

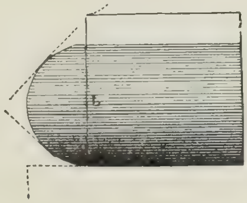


FIG. 10 — Torus.

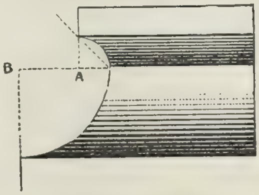


FIG. 11. — Scotia.

The scotia (Fig. 11) is composed of two quadrants of circles between two fillets. B is the centre for describing the large quadrant; A the centre for describing the small quadrant. The upper portion may be made larger or smaller than in the diagram, but the centre A must always be in the line B A.

The ovolo (Fig. 12) is composed of a quadrant between two fillets. C is the centre for describing the quadrant.

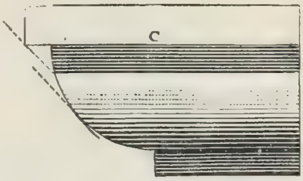


Fig. 12. — Ovolo.

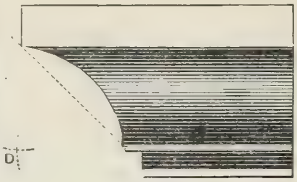


Fig. 13. — Cavetto.

The cavetto (Fig. 13) is composed of a concave quadrant and two fillets. The centre of the quadrant is at D.

The cyma recta (Fig. 14) is composed of two arcs forming a waved line, and two fillets. To describe it, let I be the upper fillet, and N the lower fillet. Bisect I N in M; with the radius M N or M I, and N and M as centres, describe two arcs intersecting in F; and from M and I with same radius describe arcs intersecting in E. With the same radius, from E and F, describe arcs meeting in M.

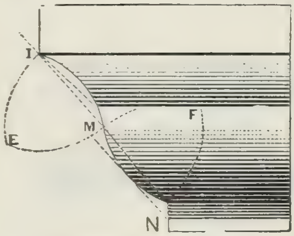


Fig. 14. — Cyma Recta.

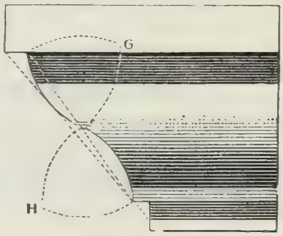


Fig. 15. — Cyma Reversa.

The cyma reversa, talon, or ogee (Fig. 15) is composed of two arcs produced from the centres G and H, and two fillets; the upper fillet projecting beyond the curve, the lower receding within it.

The cyma recta is used as the upper member of an assemblage of mouldings.

The cyma reversa is used to sustain other members.

Grecian Mouldings have elliptic, parabolic, or hyperbolic curves.

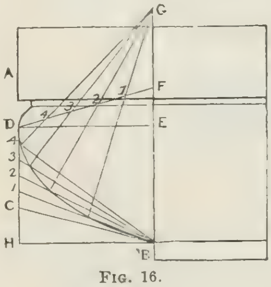


Fig. 16.

To draw the Grecian echinus, or ovolo (Fig. 16), the fillets A and B, the tangent C B, and the point of greatest projection being given: Draw B H, a continuation of the upper edge of the under fillet. Through D draw D H perpendicular to B H, cutting the tangent B C in C. Through B draw B G parallel to D H, and through D draw D E parallel to H B, cutting G B in E. Make E G equal to E B, and E F equal to H C; join D F. Divide the lines D F and D C each into the same number of equal parts. From the point B draw lines to the divisions 1, 2, 3, etc., in D C. From the point G draw lines through the divisions in D F, to intersect the lines drawn from B. Through the points of intersection trace the curve.

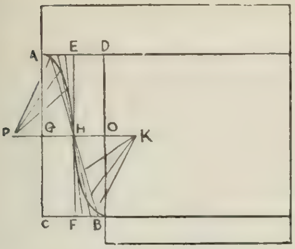


FIG. 17.

To describe the cyma recta (Fig. 17), the perpendicular height B D and the projection A D being given: Draw A C and B D perpendicular to A D, and C B parallel to A D. Bisect A D in E, and A C in G; draw E F and G O, which will divide the rectangle A C B D into four equal rectangles. Make G P and O K each equal to O H. Divide A G, O B, A E, and B F into a similar number of equal parts. From the divisions in A E and F B draw lines to H; from P draw lines through the divisions on A G to intersect the lines drawn from F B. Through the points of intersection draw the curve.

To draw the cyma reversa (Fig. 18), the fillet A, the point C, the end of the curve B, and the line B D being given: From C draw C D, and from B draw B E, perpendicular to B D; then draw C E parallel to B D, which completes the rectangle. Divide the rectangle B E C D into four equal parts by drawing F G and O P. Find the points in the curve as in Fig. 17.

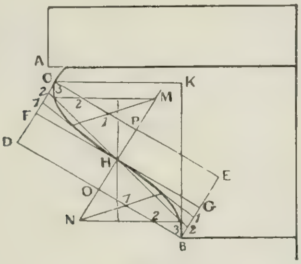


FIG. 18.

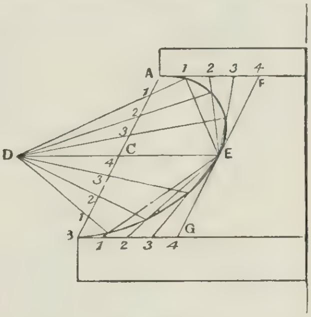


FIG. 19.

To describe the Grecian scotia (Fig. 19), the position of the fillets A and B being given: Join A B, bisect it in C, and through C draw D E parallel to B G. Make C D and C E each equal to the depth intended to be given to the scotia; then A B will be a diameter of an ellipse, and D E its conjugate. Through E draw F G parallel to A B. Divide A F and B G into the same number of equal parts, and from the points of division draw lines to E. Divide A C and B C into the same number of equal parts, as A F; then from D, through the points of division in A B, draw lines to intersect the others, which will give points in the curve.

To draw the vase in Fig. 20: Make the points *a a* distant from the ends equal to the height of the fillet forming the base; *a*, *a* are the centres of the arcs; *b*, *b* and *c*, *c* are the centres of the top part of the base; *e*, *e* are the centres for describing the arcs of the torus; make *b′ d* equal to *a a′*, and lay off, from *b′*, *h′* and *n′*; through *h′* draw *h h′ h*; join *e h*, bisect it by a line *f d* produced, meeting *h h* in *g*; *g* is the centre of the arc *h e*;

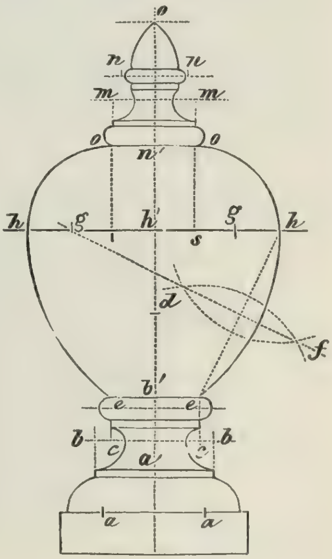


FIG. 20.

the arcs *h o*, *h o* are described from the centres *s*; *m m*, *n n* are the centres for describing the curve of the upper part.

To describe the fluting in a column where the grooves have a narrow fillet between (Fig. 21): Let *c d* be half the diameter; with a radius *c d*, from *c*, describe the arc *e d*; divide the arc into equal spaces 1, 1, 1, etc., making between them the equal spaces *n n n* of the fillets; then from the points thus obtained draw lines parallel to the side, and the fluting will appear to recede around the shaft.

To describe the spiral scroll of the termination of a hand-rail for a stair, as in Fig. 22: On the line *a* draw a square dividing it as in Fig. 23. From *a* describe the circle *n b c*; then from the point 1 (see Fig. 23) describe the curve to *c*; from point 2, from *c* to *d*; from point 3, from *d* to *e*; from 4, from *e* to *f*; from 5, from *f* to *g*; from 6, *g h*. Suppose the breadth of the rail to be *h p*: then from 6 draw the curve *p o*; from 7, *o* to *n*.

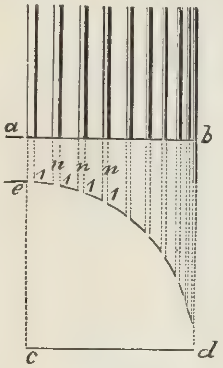


Fig. 21.

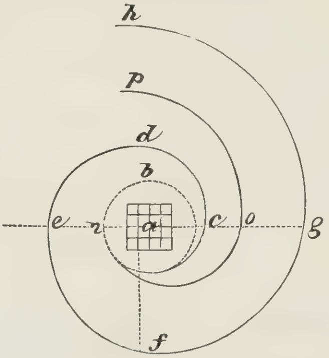


Fig. 22.

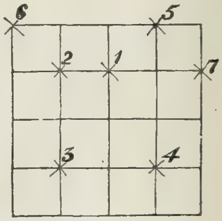


Fig. 23.

To draw the teeth of wheels (Fig. 24): The line of centres is the line A B D passing through K and C, the centres of the wheel and pinion. The proportional or primitive diameter is the line A B; the proportional radius A K or K B.

The true radii are the distances from the centres to the extremities of the teeth. The proportional diameter of the pinion is the line B D; the proportional radius C B. The

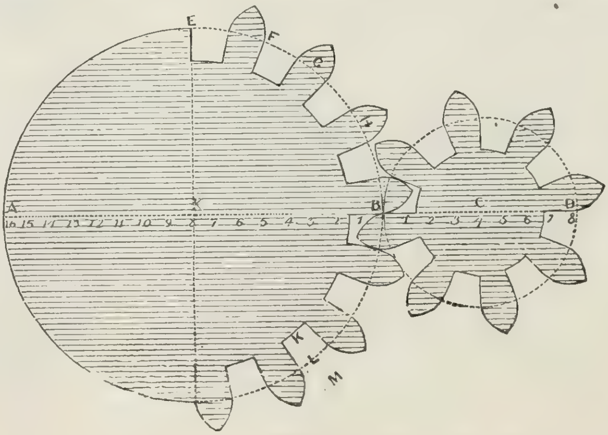


Fig. 24.

proportional circles or pitch lines are circles described with the proportional radii touching each other in B. The pitch of a wheel is the distance on the pitch circle including a tooth and a space, as E F, Fig. 24, or O D, Fig. 25; the depth of a tooth is the distance from the pitch circle to the bottom, as L K, Fig. 24; and the height of a tooth is the distance from the pitch circle to the top, as L M.

To draw the pitch line of a pinion, to contain a definite number of teeth of the same size as in the given wheel (Fig. 24): Divide the proportional diameter A B of the given wheel into as many equal parts as the wheel has teeth. With a distance equal to one of these parts, lay off on the line B D as many points as the pinion is to contain teeth, which will give the proportional diameter of the pinion.

Draw the pitch circle, and on it, with the distance E F, the pitch, lay off the teeth.

Subdivide the pitch for the tooth and space, draw the sides of the teeth below the pitch line toward the centre, and on the tops of the teeth describe epicycloids.

Fig. 25 *is another method:* A B is the pitch circle on which the width of the teeth and spaces must be laid down. Then, with a radius D E or D F equal to a pitch and a fourth from the middle of each tooth on the pitch circle as at D, describe the tops of the teeth E and F. From O describe the tops of the teeth G and D, and so on for the others.

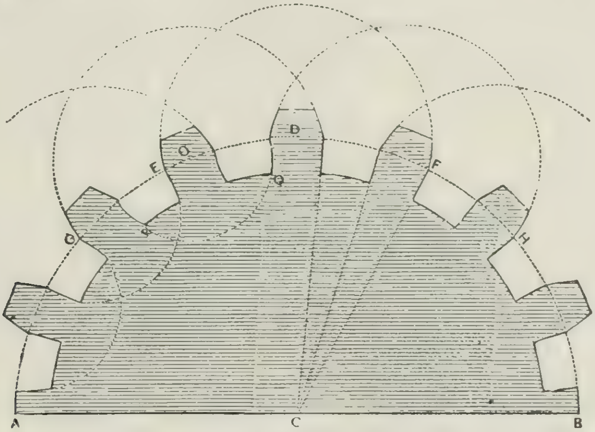


Fig. 25.

The sides of the teeth within the pitch circle may be drawn toward the centre, as at F and H; or from the centre O, with a radius equal to O Q or O P, describe the lower part of the teeth G and D.

Note. — The circumferences of circles are to each other as their diameters; if one is four times greater, the other will be four times greater.

Proportion of Circles, Fig. 26. — To assist machinists in enlarging or reducing machinery wheels without changing their respective velocities.

First, lay off two circles, D F and G I, the size of the largest wheels which you wish to change to a large or small machine, with the central point H of the smaller circle G I on the periphery of the largest circle D F; then describe two lines Q C and S A tangent to the circles as shown in diagram; then draw the line R B through their centres. Now if you wish to reduce the machine, outline a circle of the size you wish to reduce it to; if, say, one half, have the centre K one half the distance from E to P, and lay off the circle J L, and on its periphery N as a centre lay off a circle M O, with their peripheries touching the tangent lines Q C and S A, as shown in diagram. This will make the circle J L one half the size of the circle D F, and the circle M O one half the size of the circle G I; leaving J L and M O in the same proportion to each other as D F and G I.

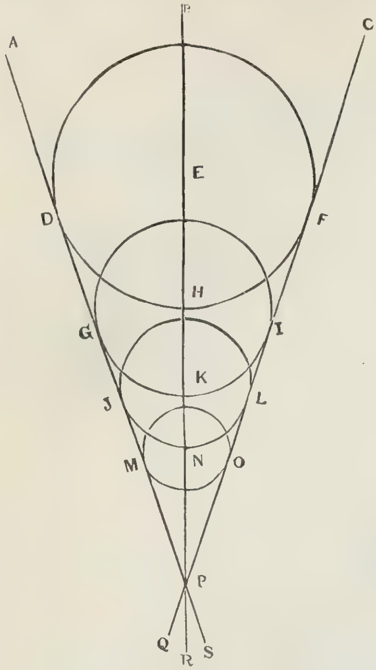


FIG. 26.

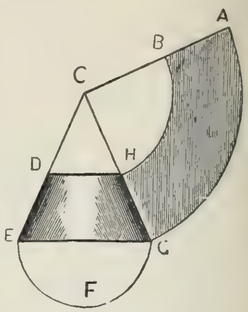


FIG. 27.

To reduce one third, have the centre K one third the distance from E to P; if one fourth, have the centre K one fourth the distance from E to P, etc.

This reckoning may be applied beyond the centre E for enlarging machine wheels, and will enable the mechanic to make the alteration without changing their respective velocities.

How to strike out the frustum of a cone. In Fig. 27, E G H D represents the desired frustum. Continue the lines E D and G H to the vertex C; then from C as a centre, with the radius C H, lay off the arc H B; also from C, with the radius C G, describe the arc G A. Make G A twice the length of E F G, drawing the line C A, and G H A B is the outline of the plate required.

To strike out can tops and bevel covers for vessels (Fig. 28): Describe the angle M A C, and from the point F, the altitude (height) you desire the breast, erect a perpendicular line H; then on the line C mark the point E one half the diameter of the can, and on the line H mark the point G one half of the opening in the top of breast; draw the line B to cross through the points E and G, to intersect the line M; place one foot of the compasses at the point I and the other on the point E, and delineate the circle E N L; next span the compasses from point I to point G, and outline the circle G D K; then span from A to E, and step the compasses six times on the circle E N L, which gives the dimensions of the breast. The allowance for the locks is represented by the dotted lines.

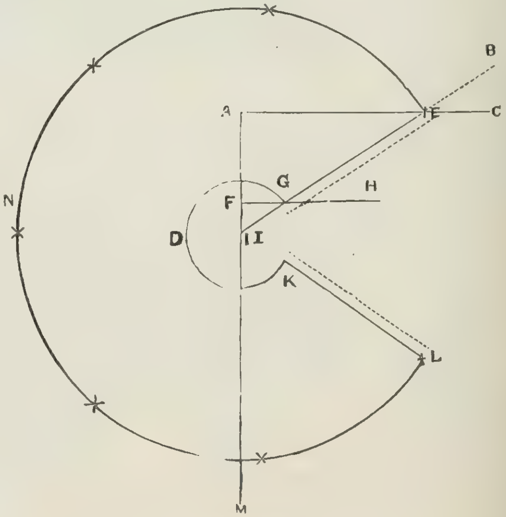


FIG. 28.

To describe a straight elbow (Fig. 29): Draw a profile of half the elbow wanted, and mark a semicircle on the line representing the diameter; divide the semicircle into six equal parts; draw perpendicular lines from each division on the circle to the angle line as on figure. Draw the circumference and depth of elbow wanted, and divide into twelve equal parts; mark the height of perpendicular lines of Fig. 29 on Fig. 30, *a*, *b*, *c*, etc.;

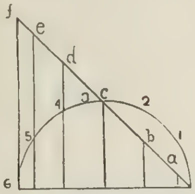


FIG. 29.

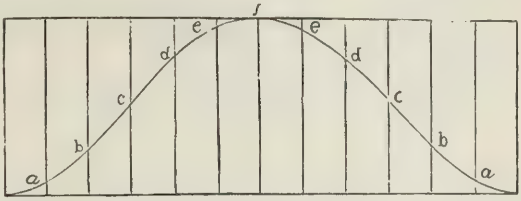


FIG. 30.

set your dividers the same as for the semicircle, and sweep from *e* to *e*, intersecting with *f*, and the same from *a* to the corner; then set the dividers *one third* the circumference and sweep from *e* to *d* on both sides, and from *a* to *b* on both sides at bottom; again set your dividers *three fourths* of the circumference and sweep from *c* to *d* each side on top, and from *c* to *b* at bottom, and you obtain a more correct pattern than is generally used.

Allow for the lap or seam outside of your drawing, and lay out the elbow deep enough to put together by swedge or machine. Be careful in dividing and marking out, and the large end will be true without trimming. The seams must be added to drawing.

MAP DRAWING.

MAP DRAWING is excellent practice for familiarizing one's self with the locality of various countries.

Rule the border of the map and the perpendicular meridian through the middle. Draw the other meridians and parallels, curving them more or less according to the position of the country. The parallels of North America or Asia must curve considerably, while those of Africa or South America may be very slightly curved, or even ruled straight, without affecting the form of those countries, since they are mostly within the torrid zone. Number the parallels and meridians to correspond with the model. Select prominent points of the outline, and indicate them accurately by counting the degrees of latitude and longitude. Continue the coast from point to point, carefully considering on or near which parallel or meridian intermediate points should come. Divide the perpendicular meridian into spaces of one, two, or five degrees each, according to the country represented and the size of the map. Through the division points draw the parallels of latitude, curving them more or less according to the position of the country. The centre of curvature will be on the side of the nearest pole. Mark off upon each parallel, right and left from the central meridian, spaces varying in accordance with the fact that degrees become smaller and smaller as the parallels become smaller approaching the poles. Draw meridians through the division points of the parallels. Unless great accuracy be required, however, the meridians may be ruled straight.

To enlarge or diminish any map, divide it into squares by drawing light lines, and divide your paper, whether larger or smaller, into an equal number of squares, which will serve to indicate the principal points proportionately nearer or farther apart.

ARCHITECTURE.

ARCHITECTURE has five orders: the Tuscan, Doric, Ionic, Corinthian, and Composite.

Each order has three parts: pedestal, column, and entablature.

The pedestal is composed of three parts: the plinth, die, and cornice.

The column has three: base, shaft, and capital.

The entablature three: architrave, frieze, and cornice.

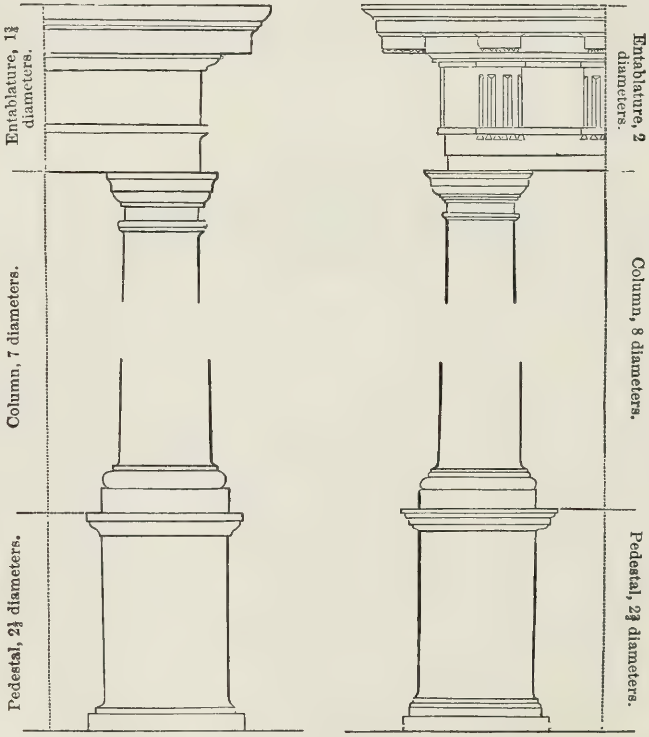

TUSCAN ORDER. DORIC ORDER.

FIG. 31.

The *Tuscan* order is distinguished by its simplicity, having no ornament; the *Doric* by the triglyphs which ornament its frieze; the *Ionic* by the volutes of its capital; the *Corinthian* by the leaves which ornament its capital; and the *Composite* by the Corinthian capital united with the volutes of the Ionic.

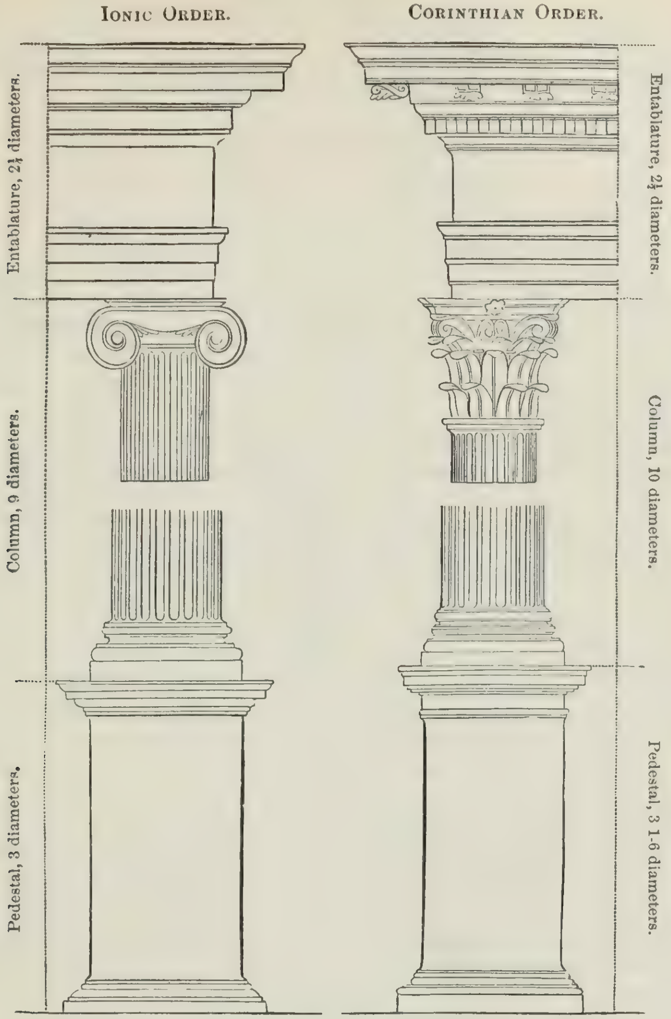


Fig. 32.

In the Tuscan order, the height of column, including base and capital, is seven times the diameter of the shaft at the base; that of the Doric column eight times; that of the Ionic nine times; and that of the Corinthian and Composite ten times.

In all orders the pedestal is one-third the height of the column, and the entablature one quarter the height.

A module in all orders except the Doric is the diameter of the shaft at the base; in the Doric it is the semidiameter.

In the Doric order the module is supposed to be divided into thirty equal parts, and in the other orders sixty; each part being called a minute.

The shafts diminish in diameter as they rise; sometimes the tapering begins at the foot

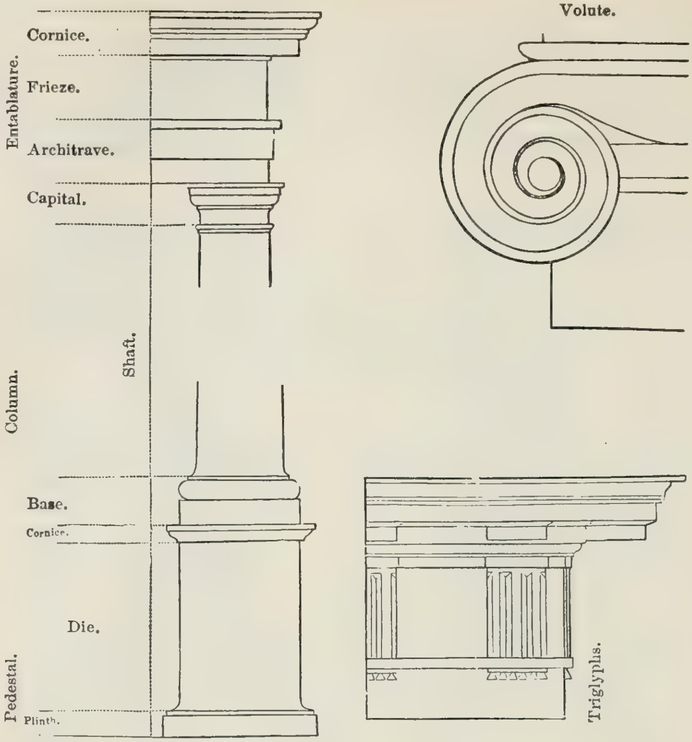


Fig. 33.

of the shaft; sometimes from a point one quarter from the base, or one third; in some examples there is a swelling in the middle.

The total height of the entablature in all the orders except the Doric is divided into ten parts: three to the architrave, three to the frieze, and four to the cornice. But in the Doric order the whole is divided into eight parts: two to the architrave, three to the frieze, and three to the cornice. The Ionic order has usually a very simple entablature; the architrave has one or two *fasciæ;* the frieze is plain; and the cornice has four parts. In the Composite the entablature is large for so slender an order.

The different parts will be understood by referring to the illustrations.

Of the three classic orders of Greece the Doric was first developed, taking its name from the Dorians, who produced it at least six centuries before the Christian era. It is characterized by simplicity and strength; hence was preferred and chiefly used for grand temples, like that of Jupiter, at Athens, and that of Apollo, at Delphi.

The Ionic, originated by the Ionians, came into use at a later period, and was occasionally employed in massive structures, like the temple of Diana, at Ephesus, but less frequently than the Doric. Its characteristics are grace and delicacy.

The Corinthian was last in time and importance, and, on account of its lightness and richness of decoration, was employed only in buildings of comparatively small dimensions.

The Tuscan order belongs to Roman architecture, and was borrowed from the Etruscans when Grecian architecture was in its decline. It is simpler than the Doric, and is impressive in its massiveness and lack of ornament.

DESIGNING.

DESIGNING is required in the manufacture of a great variety of goods: dress goods, carpets, oil-cloths, wall paper, furniture, etc. A good designer commands a high salary. Designing requires great originality, and much practice in the combination of straight lines and curves in the form of scroll work and leaves, flowers, figures, etc. Flowers and leaves, from their multifarious and symmetrical forms, have always supplied a great proportion of the ideas used in architectural and other classes of designs.

Those figures should be combined which bear some relation to one another, and which conform as nearly as may be to some one idea. It is better to have a few simple yet beautiful figures combined, which will present a symmetrical whole readily understood, than a mass consisting of a great variety of figures, which, though beautiful in themselves, are unpleasing from manifest lack of design.

Curves cut out of thin wood can be had for making scroll work; but designing must be studied, in regard to the combination of figures, from pictures of designs, from the various cathedrals, and works of art of the great masters. Flowers have always been popular as forming the basis for designs, and especially is this so at the present day. Designing requires a complete knowledge of the various forms and modifications of vegetation. The student should go to nature direct for his ideas, and by copying from nature he is obliged to study its arrangements, while its forms are more completely impressed upon his mind; forming, what is necessary for the purpose, a storehouse to draw from at will, so that when needed he can bring forward the most appropriate design required for the purpose.

A student, or one anxious to master any particular branch of designing, in order to succeed must bring to it application and a determination to succeed if possible. For instance, a designer of wall paper should select patterns or copies of the most popular designs, and study them thoroughly, so that he may know the reason for such success; and he should become familiar with the groundwork of such designs, and then endeavor to evolve something original from his own mind, or at least to try to combine what is most popular in what he sees. At first his efforts may be crude, or may not suit him; but each attempt brings its lesson, and if he feels an inclination for the study he should persevere, and eventually he may accomplish what he aimed at, and find his talents crowned with success.

From what has been said, it will appear that success as a designer depends more upon the artistic taste and originality of the individual than upon prescribed methods. There are a few general principles, however, which may be stated without harm, though they will be intuitive with an original artist.

There must be adopted from nature some one or more of her designs as symbols of grace, beauty, strength, and order; and these four ideas must be manifest in every design, one or another being more prominent in accordance with the special subject under treatment. We do not mean to be understood as advocating *imitation*, even of nature, but the *creation of ideas*, using nature's symbols. Simplicity should be a fundamental rule of the designer. He ought to understand the nature and tastes of the public for whom he creates, and govern himself accordingly in his endeavor to educate it up to his standard. He cannot force people to adopt ideas, however just, at once, but he can gradually lead them to an appreciation of the true and beautiful in art.

PERSPECTIVE.

LUMINOUS objects, as the sun, are seen by their own direct rays; but all other objects are seen by reflected light, and the power of reflecting light depends upon the object. The farther the object is from the eye, the less distinct it becomes; because the light reflected from it becomes to a great extent disseminated, not being able to overcome the power of absorption and counteracting rays from other objects before it gets to the eye. The angle of vision formed by two lines from the eye to the extremities of an object becomes proportionately less as the object becomes more distant, and it therefore appears smaller.

When an object is viewed obliquely, it appears much shorter, and this decrease is called foreshortening.

Linear Perspective teaches the mode of drawing the lines of a picture, so as to convey to the eye the apparent size and shape of each object from the point at which it is viewed.

Aerial Perspective teaches the mode of arranging the direct and reflected lights, shades, and shadows of a picture, so as to give to each part its requisite degree of tone and color, diminishing the strength of each tint as the objects recede, until in the extreme distance the whole assumes a bluish gray, which is the color of the atmosphere. *Linear perspective* is capable of mathematical demonstration, but aerial perspective must be studied from nature or from the pictures of masters.

The perspective plane is the surface on which the picture is drawn, and is supposed to be placed in a vertical position before the spectator.

The *ground line* is the lower edge of the picture.

The *horizontal line* runs lengthwise of the picture, at the height of the eye of the spectator.

The *station point* is the position from which the view is taken.

The *point of sight* is a point on the picture directly opposite the eye, situated in the horizontal line.

Visual rays are all lines drawn from an object to the eye of the spectator; the middle visual ray runs to the point of sight. As objects grow smaller they will vanish in a point, and the point of sight is the principal vanishing point, because all lines parallel to the middle visual ray vanish in that point.

The *vanishing points* of horizontal objects not parallel with the middle ray will be in some point of the horizontal line, but not the point of sight. The surfaces bounded by lines which converge to a point in the distance will become smaller until they vanish in that point, and are termed vanishing planes. In viewing a room, the ceiling and floor would constitute horizontal planes and the walls vertical planes, which if sufficiently extended would all vanish in one point. Planes parallel to the plane of the picture have no vanishing point. All lines parallel to a plane vanish in the same point as the plane itself.

PROBLEMS.

To draw a *perspective plan* of a square and divide it into a given number of squares, say sixty-four (Fig. 34): Let G L be the base line, V L the horizon, S the point of sight, and

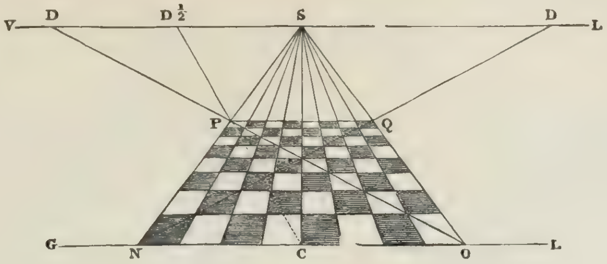


FIG. 34.

N O the given side of the square. From N and O draw rays to S and diagonals to D D, intersecting each other in P and Q; draw P Q; divide N O into eight equal parts, and from the points of division draw rays to S. Through the points of intersection formed with those rays by the diagonals draw lines parallel to N O, which will divide the square as required. When the points of distance are too far off to be used conveniently, half the distance may be used; as, for example, if we bisect S D in $D\frac{1}{2}$ and N O in C, and draw a line from C to $D\frac{1}{2}$, it will intersect N S in P, — the same point cut by the diagonal drawn from O through the opposite side of the square to D.

NOTE. — Any other fraction of the distance may be used, provided that the divisions on the base line be measured proportionately.

In drawing this or any plan you can draw your figures to a certain scale, as $\frac{1}{8}$, $\frac{1}{4}$, or $\frac{1}{2}$ inch to the square foot, according to the size you wish your drawing

NOTE. — N D may be anywhere on the horizontal line.

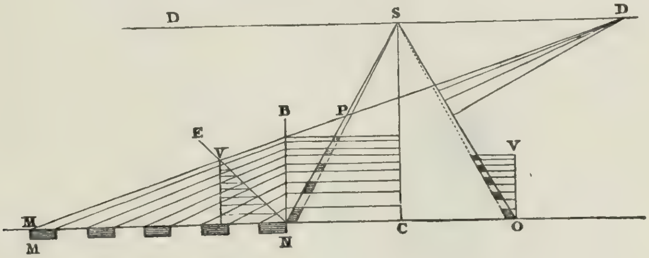


FIG. 35.

To shorten the depth of a perspective drawing, thereby producing the same effect as if the points of distance were removed much farther off: Let all the principal lines (Fig. 35) be given as above, and the pilasters and spaces laid off on the base line from N. From the dimensions on the base line draw diagonals to the point of distance D. The diagonal from M, the outside pilaster, will intersect N S in P. From N erect a perpendicular N B to intersect the diagonals, and from those intersections draw horizontal lines to intersect N S. If from N we draw the inclined line N E, and transfer the intersections from it to V O, it will reduce the depth much more, as shown at O S.

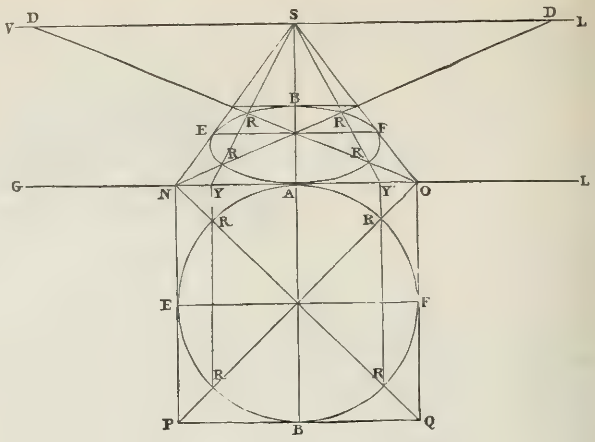


FIG. 36.

To draw the perspective representation of a circle viewed directly in front and touching the perspective plane: Circumscribe the circle (Fig. 36) with a square; draw the diagonals of the square P O and N Q, and the diameters of the circle A B and E F; also through the intersections of said diagonals with the circumference draw the chords R R, R R, continued to meet the line G L in Y and Y′. Put the square in perspective as before shown; draw the diagonals N D and O D, and the radials Y S and Y′ S. From A draw A S, and through the intersection of the diagonals draw E F parallel to N O. Through the points of intersection thus found—viz., A, B, E, F, R, R, R, R—trace the curve.

This method gives eight points in the curve, which joined would form an octagon. If diameters half-way between those given be drawn, you will have sixteen points through which to draw your curve, which will make it more accurate.

Fig. 38 is the plan of a square whose side is nine feet; each side is divided into nine parts, and lines from the divisions drawn across in opposite directions; the surface is therefore divided into eighty-one squares. G L (Fig. 37) is the base line and D D the horizon.

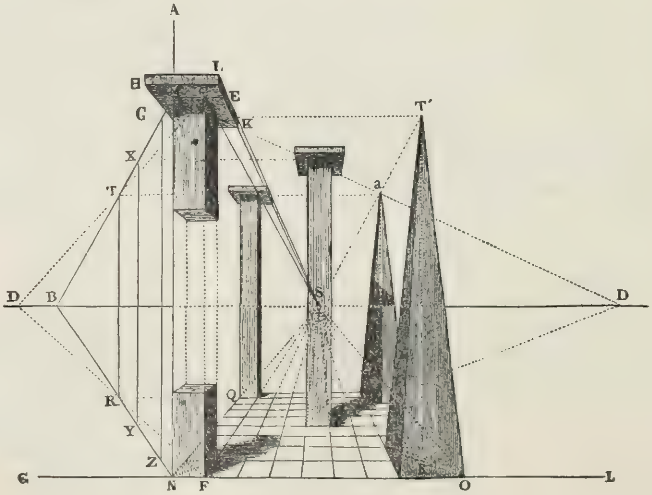


FIG. 37.

1. To put the plan with its divisions in perspective, one of its sides N O to coincide with the perspective plane: Transfer the measures from the side N O, Fig. 38, to N O on the perspective plane, Fig. 37, and put the plan in perspective by the methods before described.

2. To erect square pillars on the squares N Q W, nine feet high and one foot in diameter, equal to the size of one of the squares on the plan: Erect indefinite perpendiculars from the corners of the squares. On N A, one of the perpendiculars that touches the perspective plane, lay off the height of the column N M from the accompanying scale; then N M is a *line of heights*, on which the true measures of the heights of all objects must be set.

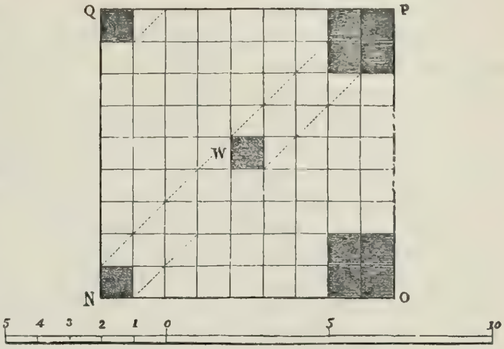


FIG. 38.

Two lines drawn from the top and bottom of an object on the line of heights to the point of sight, point of distance, or to any other point in the horizon, form a scale for determining similar heights on any part of the perspective plan. To avoid confusion they are here drawn to the point B. Through M draw M C parallel to N O, and from C draw a line to the point of sight, which determines the height of the side of the column, and also the back of the column erected on Q; and through the intersection of the line C S with the front perpendicular draw a horizontal line, forming the top of the front side of the column Q.

To determine the height of the pillar at W: Draw a horizontal line from its foot intersecting the proportional scale N B in Y; from Y draw a vertical line intersecting M B in X; then Y X is the height of the front of the column W. By the same method the height of the column Q may be determined as shown at R T.

To draw the caps on the pillars: On the line C E, a continuation of the top of the front, set off the amount of projection C E, and through E draw a ray to the point of sight. Through C draw a diagonal to the point of distance, and through the point of intersection of the diagonal with the last ray drawn, draw the horizontal line H, forming the lower edge of the front of the cap.

Through M draw a diagonal to the opposite point of distance, which determines the position of the corners H and K. Erect perpendiculars on all the corners, lay off the height of the front, and draw the top parallel with the bottom. A ray from the corner to the point of sight will complete the cap; the other caps can be drawn by similar means.

As a pillar is a square column, the terms are here used indiscriminately. To erect square pyramids on O and P of the same height as the pillars, with a base of four square feet, as shown in the plan: Draw diagonals to the plane of the base, and from their intersection at R′ draw the perpendicular R′ T′. From R′ draw a line to the proportional scale N B, and draw the vertical line Z G, which is the height of the pyramid. Make R′ T′ equal to Z G, and from the corners of the perspective plan draw lines to T′, which complete the front pyramid. A line drawn from T to the point of sight will determine the height of the pyramid at *a*. The dotted lines on the plan show the direction and boundaries of the shadows; they have been projected at an angle of 45° with the plane of the picture.

To draw semicircular or pointed arcades on either side of the spectator, running parallel to the middle visual ray, N P and Q O, the width, being given, and P Q, the space between

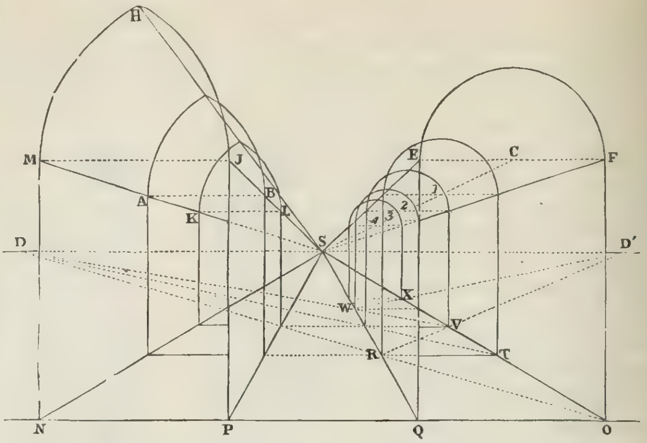
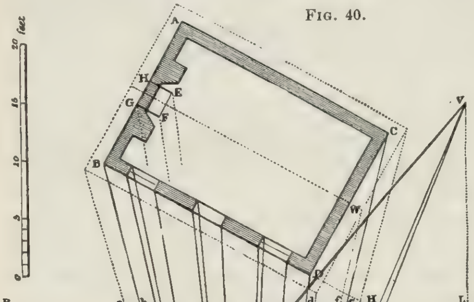


Fig. 39.

them (Fig. 39): From N, P, Q, and O erect perpendiculars, make them all of equal length, and draw E F and M J. For the semicircular arches bisect E F in C, and from E, C, F, O, and Q draw rays to the point of sight. From C describe the semicircle E F. Let the arches be the same distance apart as the width Q O; then from O draw a diagonal to the point of distance, cutting Q S in R; from R draw a diagonal to the opposite point of distance, cutting O S in V; from V draw a diagonal to D, cutting Q S in W; and from W to D′, cutting O S in X.

Through R, V, W, and X draw horizontal lines to intersect the rays O S and Q S, and on the intersections erect perpendiculars to meet the rays drawn from E and F. Connect the tops of the perpendiculars by horizontal lines, and from their intersections with the rays drawn from C in 1, 2, 3, and 4 describe the retiring arches. For the Gothic arches continue the horizontal lines across from R and V to intersect the rays P S and N S, and from the points of intersection erect perpendiculars to intersect the rays drawn from M and J. From M and J successively, with a radius M J, describe the front arch, and from H, the crown, draw a ray to S; from A and B, with the radius A B, describe the second arch; and from K and L describe the third arch.

Fig. 40.



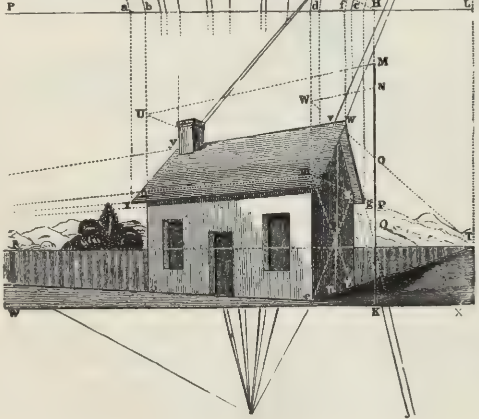


Fig. 41.

All the arches here represented are parallel to the plane of the picture; and although each succeeding arch is smaller than the arch in front, all may be described with the compasses.

To draw the perspective view of a cottage seen obliquely (Fig. 40): Let A B C D be the plan of the cottage, twenty feet by fourteen, drawn to the accompanying scale. The shaded parts show the thickness of the walls and position of the openings; the dotted lines outside parallel with the walls give the projection of the roof, and the square E F G H the plan of the chimney above the roof. Let P L be the perspective plane and S the station point. Continue the side B D to intersect the perspective plane in H, to find the position for a line of heights.

From all the corners and jambs on the plan, draw rays toward the station point to intersect the perspective plane. Through S draw a line parallel to the side of the cottage D C, to intersect the perspective plane in L. This gives the vanishing point for the ends of the building, and for all planes parallel to it; viz., the side of the chimney, and jambs of the door and windows. Through S draw a line parallel with B D, to intersect the perspective plane, which it would do at some distance outside; this intersection would be the vanishing point for the sides of the cottage, for the tops and bottoms of the windows, the ridge and eaves of the roof, and for the front of the chimney.

Fig. 41. Let us suppose the parallelogram P L W X to be a separate piece of paper laid on the other, its top edge coinciding with the perspective plane of Fig. 40, and its bottom edge W X to be the base of the picture, then proceed as follows: —

Draw the horizontal line R T parallel to W X and five feet above it. Draw H K perpendicular to P L for a line of heights. Draw a line from K to the vanishing point without the picture, which we will call Z; this will represent the line H B of Fig. 40 continued indefinitely. From *b* and *d* draw perpendiculars to intersect the last line drawn, in *o* and *e*, which will determine the perspective length of the front of the house. On K H set off twelve feet, the height of the walls at O, and from O draw a line to the vanishing point Z, intersecting *d e* in *m* and *b o* in *n*. From *m* and *e* draw vanishing lines to T, and a perpendicular from *c* intersecting them in Y and *s*; this will give the corner Y, and determine the depth of the building.

Find the centre of the vanishing plane representing the end, by drawing the diagonals *m* Y and *e s*, and through their intersection draw an indefinite perpendicular *n v*, which will give the position of the gable.

To find the height of the gable, set off its proposed height, say 7′ 0″, from O to N on the line of heights; from N draw a ray to Z, intersecting *e d* in W, and from W draw a vanishing line to T, intersecting *n* V in *v*; then *v* is the peak of the gable. Join *m v*, and prolong it to meet a perpendicular drawn through the vanishing point T, which it will do in V; then V is the vanishing point for the inclined lines of the ends of the front half of the roof. The ends of the backs of the gables will vanish in a point perpendicularly below V, as much below the horizon as V is above it.

For the roof: Through *v* draw a perpendicular to intersect it in *g*, and through *g* draw a line to Z, which completes the roof. For the chimney: Set off its height above the ridge at M; from M draw a line toward the vanishing point Z, intersecting *o b* in U; from U draw a line to the vanishing point T, which gives the height of the chimney; bring down perpendiculars from rays drawn from G F and E (Fig. 40), and complete the chimney by vanishing lines drawn for the front toward Z, and for the side toward T.

For the door and windows: Set off their heights at P Q and draw lines toward Z; bring down perpendiculars from the rays as before, to intersect the lines drawn toward Z; these lines will determine the breadth of the openings. The breadths of the jambs are found by letting fall perpendiculars from the points of intersection; the top and bottom lines of the jambs are drawn toward T.

As the bottom of the front fence, if continued, would intersect the base line at K, the foot of the line of heights, and its top is in the horizon, it is therefore five feet high.

Freehand Drawing.

It is invariably the custom with art teachers and writers to instruct their pupils in the elementary lessons in what is called freehand drawing from the *flat;* that is, copying designs from given examples. This practice has its advantages, but they are few when compared with model or object drawing, and we shall treat it accordingly.

A few freehand drawing copies, some common cartridge paper, drawing pins with which to attach the paper to the drawing board, and two lead pencils, one marked H. (hard) for first outlines, the other H. B. (hard black) for finishing outlines, are the necessary articles, which can be bought of any dealer in artists' materials.

Trim your pencil neatly to a point, and hold it as is most convenient for the kind of work you are doing.

The aim of the beginner should be to correctly imitate the example chosen. He must not resort to the use of compasses, rules, etc., nor take mechanical measurements under any pretence; the object being to produce a *freehand* copy, — to train the eye to direct and the hand to execute the commands of the mind. To employ any external aid would directly defeat his own ends. A little stale bread crumb or india-rubber may be sparingly used; the less used the more progress will be made.

Suppose your example to be a leaf: measure patiently and carefully *with your eyes* the length of a line drawn through the centre *a b*, Fig. 42; having determined, make two small marks on your paper to represent it: then mark well its direction, and draw it very lightly; do likewise with the width *c d*, taking particular notice of the angle it forms with *a b*. Then sketch very lightly the outline *o o*. Before going any further, be satisfied that what you have done is correct. You may obtain the proportions more accurately by determining as nearly as possible the principal points, and through them drawing perpendicular and horizontal lines lightly, so that they can be easily erased afterward.

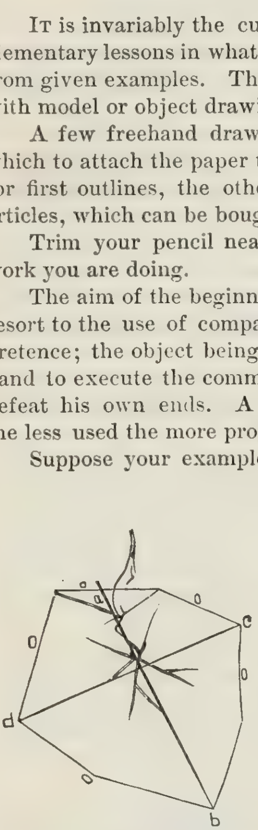


Fig. 42.

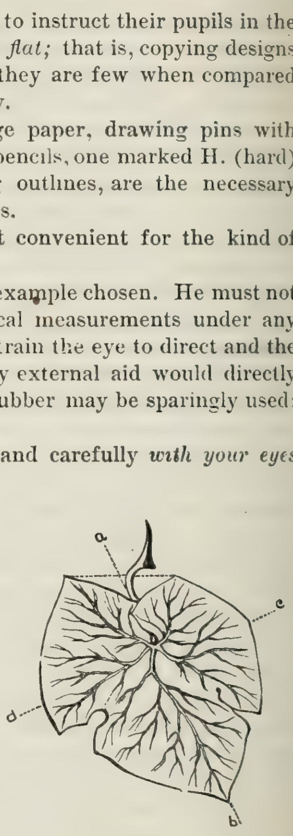


Fig. 43.

If you are sketching objects in a room, you can obtain your principal points by holding your pencil or a little stick perpendicularly or horizontally before one eye, closing the other, and observing at what intervals on the pencil the principal points come. Having satisfied yourself that your points are correct, — or, as in the first method, having obtained a correct boundary, — slightly erase the superficial pencil marks and draw in the detail (Fig. 43), making your lines simple, few, and straight, taking care to relieve them by varying their thicknesses. Perhaps it would be as well to remark here that the merits of outline drawing consist in correctness and in expression, — *i. e.*, a proper strength of line where it is needed. What a sameness would be presented by the drawing of a figure or piece of drapery in which the lines were all of like strength and thickness! Although this matter is subject for discussion in the different schools, under the title "propriety of outlines," the method we commend as the most expressive and certainly the most beautiful is practised by nearly every great living artist.

In every example the learner copies, he must employ the same means as in the first instance. No matter what the subject is, it has a *boundary; and unless that is correctly marked on the paper, no amount of labor or skill can produce a good result.*

Arrange five books, — one as a base, two at the sides, one on top, and one at the back, thus forming, as it were, a room with the front open; then, with one eye closed, place the other in a position directly in front of the centre of the back, and you will observe the fact that all the lines running in the direction in which you are looking converge to a certain point, which is called the point of sight. The lines below run up to that point, and those above run down to the point. Before *sketching*, therefore, determine your point of sight by holding your pencil horizontally before your eye and noting what lines appear neither running up nor down. Place a dot on your paper high enough up to take in all you wish to sketch, and to the right or left, according to the position from which you view the objects you are sketching.

A careful study of the article on Perspective Drawing will fit you to understand freehand drawing better than you could otherwise. Contrast in light and shade constitutes the principal attraction in a picture, and serves to give a more *real* effect to all the objects which are affected by it. Therefore, in selecting objects to copy, contrive to have dark objects represented against a light ground and light objects against a dark ground, and as far as possible let the distinctive outline in every case be thus given relief. Do not, however, have half a face in front of a dark ground, and the other half of the outline in front of some object of the same depth of shade as the face.

Throw the principal contrasts into the centre of your picture.

Station yourself sufficiently far from the objects you are drawing so that they will not appear as if you were looking down upon them. In sketching from nature, make a selection of a few simple, prominent objects that will look well in a picture.

Do not have a wide expanse of field in front of the principal objects, but make the base line of your picture come high enough to take in only what will look well. Neither should you have too wide an expanse of sky, but make all subordinate to the principal part of your subject.

Select those objects that are in strong contrast, and bring out their details well, especially the points that are strongly characteristic of the objects you are sketching.

Subordinate parts of a picture should not be brought out too much in detail; for in viewing a scene, those parts only at which we look directly are distinctly impressed upon the retina of the eye, while surrounding parts are indefinite.

Study the character of objects when brought in strong relief, as a branch or tree against the sky. In whatever part you may concentrate the objects of interest, do not put a striking object — as a tower, tree, etc. — exactly in the middle of your picture, nor have a horizontal line — as of an expanse of sea — come exactly half-way between the top and bottom, unless you wish to detract from its artistic effect by mechanical uniformity.

Reflections in the water should be especially brought out in the case of principal objects, but subdued in the foreground.

For shading you require a darker pencil; and for ordinary depths of shade a B. will be dark enough, but 2 B.s or 3 B.s will be required occasionally.

Go over the principal parts of your sketch where it needs to be darker, and shade in accordance with general directions of lines or shades.

A strong light serves to bring out all details, but these details are more effective when the light so strikes as to throw many little points into the shade. The details must not be brought out too strongly in the deep shade, but rather indicated by heavy masses, and sharply defined when cutting a strong light.

As colors cannot be expressed in black and white, except by degrees of shade, the depth of shade, which is called the *tone* of the object, must be carefully studied. The tone of a picture may be high or low, according as the various colors are graded to a greater or less degree of depth.

The lights of a picture ought to be graded up to the highest light, which should be where the interest at least of that part of the picture centres; and dark parts must be correspondingly graded. The highest light should not, as a rule, be in the exact centre, nor in the corners, but slightly removed from the centre; and the dark part should be opposite the highest light, except that sometimes a fine effect is produced by a dark object, as a ship projected against a bright sky.

The half-tint (medium shades) is what determines the tone, and therefore should receive careful attention. Tinted papers are used to determine this, and should depend for color somewhat upon the character of the subject. You can have various tints, and select each time what will be most effective. The tints should be all light, and the strongest light can be put in with white crayon. Black crayons, which come in wood like lead pencils, and also in sticks, are used like lead pencils, except that the shading may be blended or rubbed with a paper stump.

In mere sketches, only the important shades need be put in; but in finished pictures, great care must be taken to produce as nearly as possible the exact effect in shade.

The details of leaves, or exact outline, are rarely produced, except where large or well defined against the sky or bright objects. The general effect must therefore be studied to imitate the different kinds of foliage and grasses; and this may be advantageously done from engravings, and especially photographs, as well as from nature. Care must be taken with masses of light and shade in foliage to have the general outline well defined, especially where under strong light.

Clouds are put in by smooth shades with a stump. If you are drawing with lead pencils, scrape off, on a scrap of paper, considerable of the lead; then make a stump of soft paper, rolled tightly, until a quarter of an inch or more in thickness. Rub this into the lead, and transfer to the drawing, giving your hand the direction of the clouds in rubbing off.

Figures of cows, men, etc., in landscapes, should be sketched with special care as to proportions in perspective, and the general effect only should be given by a few simple lines and shade, except where the figures are large and prominent.

A figure may be simply outlined, with the markings of the contour and shades put in with distinct lines; or it may be outlined and shaded; or, lastly, the general effect of all markings and shades may be represented by shading in masses, without definite outlines, with a view only to general effect.

Model Drawing.

THE initiatory lessons in model drawing, as in all important studies, are necessarily somewhat tedious; but in a short time the road begins to look smoother, and as the student becomes more interested he will account no pains too great spent in acquiring a skill that will prove so elevating and remunerative to him in after life.

To begin, then: having stretched a piece of strong and moderately smooth paper on your drawing board, place a flower pot or vase, or anything that impresses you with its picturesqueness, in such a light that the shadows fall in soft and broad masses; withdraw about three paces, and raise or lower your seat until the horizontal line cuts the object either above or below the middle, so that you secure the most pleasing view (see Fig. 44). Selection alone is almost infallibly the test of an artist's merit. Titian, we are told, spent three days throwing a piece of drapery about until the folds assumed the grace he desired.

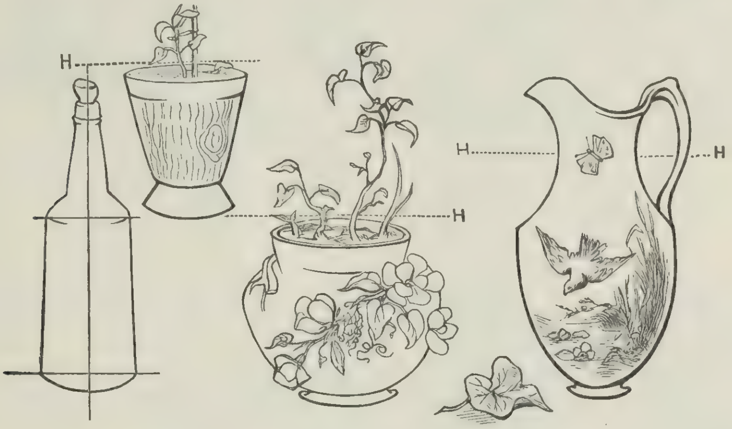


FIG. 44.

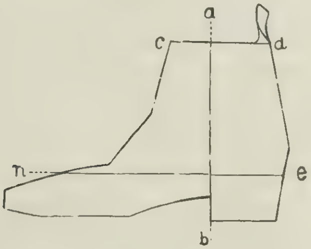


FIG. 45.

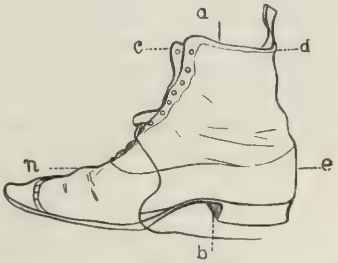


FIG. 46.

You will begin always in the upper left-hand corner, using but one pencil (H. B.), making the lines, as in freehand drawing, as light and straight as possible; remembering that the simpler they are, the easier will it be to obtain the general pose and direction of your model. As an illustration, take a boot (Figs. 45 and 46), and mark off on the paper the height *a*, the length *b*, and width across the upper *d*. Having obtained the correct dimensions, the filling in will be easy enough. After practising on such simple objects until you are capable of drawing them with tolerable accuracy, you may advance a step further and try groups, arranging the different objects so that they present a pleasing and harmonious composition.

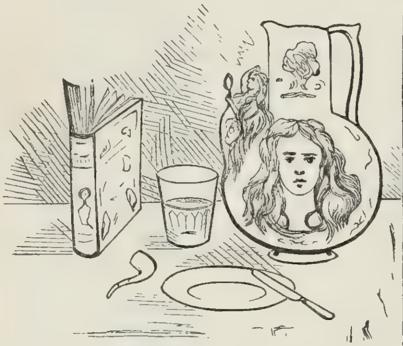


FIG. 47.

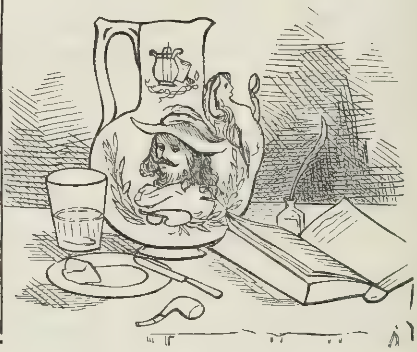


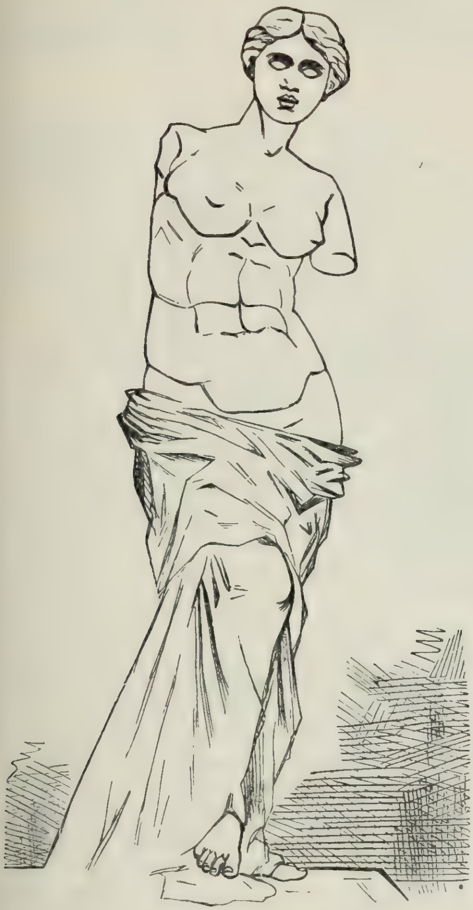
FIG. 48.

The student will readily observe by a glance at the following diagrams how important good arrangement is to the success of a picture. Fig. 47 is just as correct in its drawing as Fig. 48, but it is far from being as artistic.

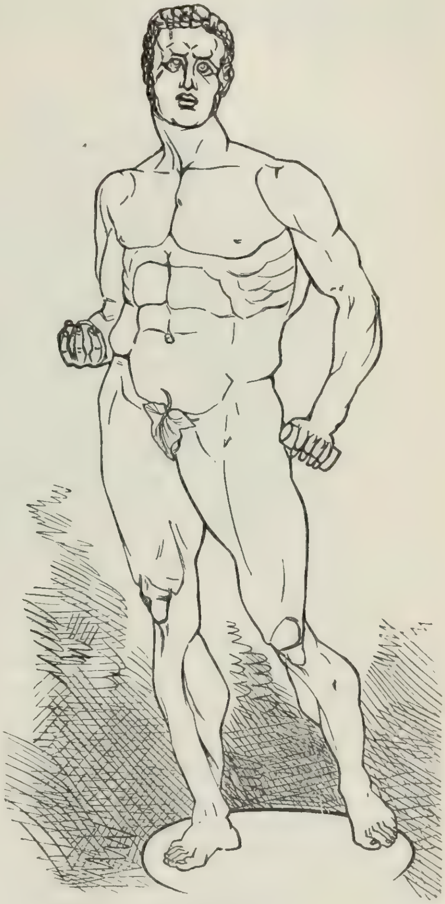
The student is cautioned against too early beginning to shade; he should practise *pure outline* until he can draw the most difficult — the human figure — with accuracy. If the pupil has followed our illustrations thus far, and can delineate with correctness any object from "still life," he may procure a few casts of hands, feet, and heads, and proceed to draw them just as he did the models; exercising the greatest pains and care in giving due expression by varying the strength of the lines.

Before studying the human figure in its entirety, the pupil should make himself thoroughly acquainted with its proportions. This he can do by carefully measuring antique casts, or good engravings from such, and the living model, making comparisons of their various proportions and thereby learning the recognized standard. He should turn aside a little and acquaint himself with the science of anatomy. It is not necessary that he should become a surgeon; but a knowledge of the position, shape, and movements of the bones and muscles of the human body is desirable. Without this knowledge the student could hardly make a drawing from life, or the cast, look natural and lifelike. It is argued that the Grecian sculptors never made anatomy a special study, and their works display the very perfection of anatomical knowledge; yet when we reflect on the many means offered them of studying the movements and actions of the various muscles of the human body in their every-day life, and in their arenas, where the youths were wont to exercise without a vestige of clothing to conceal their beauty, we readily see that they had no need to dissect dead bodies in order to understand living ones.

With many faint-hearted, would-be artists, this study is a great stumbling-block, and they try to get along without it. But if the pupil has a desire to delineate the grace and suppleness of nature with the truth that is looked for in the artist's work, he must spend all the time he can in thoroughly investigating the form and use of each constituent part of the human figure. In the article on Anatomy the reader will find a reproduction of some very fine figures, which, if studied with the intelligence they deserve, will well repay him for his labor.



VENUS DE MEDICIS.
FIG. 49



HERCULES
FIG. 50

As soon as the student becomes fairly acquainted with the bones and muscles, he may begin to draw from whole figures, keenly observing the forms assumed by the muscles in different actions, so that his knowledge may be accurate. Don't fall into the pedantic habit contracted by many otherwise promising young artists, of introducing a muscle where it is not conspicuous; but make a mental note of where it ought to be, *then draw it as you see it.*

When drawing from the cast, a plumb-line and straight stick are two articles of the greatest assistance. With the former, holding it at arm's length, you can easily determine where the salient points of the model fall, marking them as they correspond with a line drawn through the middle of your paper. The stick will aid you in getting the proportions, holding it at arm's length and measuring with your thumb. (See Fig. 51.)

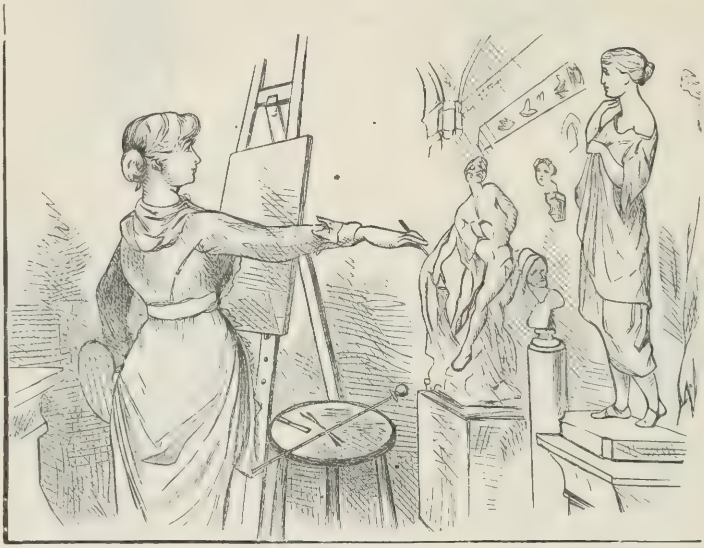


FIG. 51.

When the pupil is capable of outlining the figure with accuracy, he must turn his attention to light and shade. The pen is a good and faithful tool to work with; but where it is convenient, the brush is better. "Paint your studies," said Sir Joshua Reynolds, and this is the advice we would exhort the student to observe. Paint in black and white (monochrome) all your studies in light and shade; and on no plea waste your time in making the common and pretty chalk and pencil drawings that fancy and affectation have taught the students of to-day to produce as the best course of study,—one of which takes as long to make as half a dozen paintings, and leaves the pupil at its completion almost as ignorant in regard to the true principles of art as at its beginning. By making your studies in "monochrome" you open the way to the future use of colors. When you have become well acquainted with the laws of light and shade, you approach the end of your preparatory studies, and set your palette. But don't too early gratify your desire for color, or you will be sure to find *failure* stamped on everything you do. The builder lays a foundation before he erects a building. The art student can do no less.

Provided the pupil has fully and intelligently observed the instructions in the foregoing pages, he will experience comparatively little difficulty in comprehending those which follow.

PAINTING.

THE character and formation of objects can be expressed by lines and light and shade; but by means of color we are enabled to reproduce their exact variations and specific qualities. To handle colors properly will prove a greater task to the pupil than to acquire the greatest proficiency in any other medium; but then, as an acquirement, it is more valuable than the perfection of line and black-and-white drawing.

Everybody experiences more or less pleasure when viewing a beautiful stained-glass window, but comparatively few appreciate the merits of a fine etching or engraving.

Colors are either *primary*, *secondary*, or *tertiary*.

Primary colors are those which are not compounded. They are red, yellow, and blue, to which are added black and white. These latter are not, theoretically speaking, colors; still they are as essential to the artist as the former. By the judicious mixture of these, all varieties of color are produced.

Secondary colors are obtained by the mixture of two primaries: thus, red and yellow produce orange; yellow and blue, green; red and blue, purple.

Tertiary colors are formed by compounding the secondaries and primaries: from orange and purple we obtain brown, etc.

Harmony consists in a proper arrangement of *warm* and *cool* colors. Yellow is the warmest of all colors; red follows next in order; blue and black are the coolest. Consequently, as colors partake of the former or latter, so they incline to warmth or coolness.

Colors affect and modify each other by their proximity. For instance, if you lay a little pure blue on a white ground and place beside it some pure yellow, you will perceive the blue assume a purple and the yellow a green tinge. A careful observation of this fact will prove of the greatest assistance in dealing with the difficulties of color.

The laws of theoretical harmony are the same in all kinds of painting. An acquaintance with the fundamental principles of harmony can only be obtained by carefully studying the works of great masters. There are no theories that can teach the student how to produce a fine piece of color; neither is there any royal road to harmony.

Water Colors are powders mixed with gum or glycerine and distilled rain-water. Those sold in cakes are good enough for ordinary purposes; but where expense is not so much an object as pure coloring, we strongly advocate those put up in small earthenware pans, as being more cleanly and better adapted to producing the desired result than any others. The smaller brushes should be made of sable-hair; and in purchasing, be sure that the hair is stiff and springs back into its original position, terminating in a fine point. The larger ones should be of camel's hair; those sold in quills are the best. An earthenware palette, called a *slant*, is needed in which to prepare and dilute the colors, which are to be *mixed* on a china thumb palette. On no account mix them in the slant, for the object of this article is to preserve them in their pristine purity. *Never have more than six colors in use at the same time*, as a greater number would only tend to confuse and destroy the unity of your work. This applies to brushes also: three are enough for any picture.

Colors necessary for landscape painting are: —

White — Chinese, or zinc; *Yellows* — aureolin, raw sienna, chrome; *Greens* — emerald, terra vert; *Reds*—scarlet, vermilion, Venetian red, madder lake, burnt sienna; *Browns*—Vandyke, madder; *Blues*—Prussian, ultramarine, indigo, and cobalt; *Blacks*—India ink, ivory.

It commonly occurs that the first step taken by a beginner in studying the arts is that of laying in a great store of materials, which prove utterly useless to him in his progress.

Benjamin West painted his first picture with chalks and dyes for colors, and the fur of a cat for brushes.

Turner attributed his wonderful knowledge of color to the fact of his having been employed when a youth in tinting architectural drawings, the coloring of which, you have learned in a former chapter, should be of the simplest kind.

The best paper for water-color drawing is Whatman's, which is made with a variety of surface textures. That marked H. P., signifying *hot pressed*, has a very smooth surface, and is used where high finish is required, such as in architecture and small figure work. That marked N. or "not," signifying "*not hot pressed*," is a very useful paper, much used for landscapes and effective figure studies. That marked R., signifying "*rough*," is a paper much in vogue with disciples of the "slap-dash" school; it is only fit for rough sketching from nature.

There is another common paper called "cartridge," but this is only used for cartoon drawing and transferring.

Pencils are sold in different degrees of hardness, varying from 5 H.s (very hard) to 6 B.s (very black); but for ordinary purposes H. or H. B. is the most useful. For architectural and engineering draughtsmanship, 3 H. is generally used.

You must be provided with a stretcher composed of four pieces of wood, which you cover with strong cartridge paper or calico, and on which you paste your drawing paper. To do this properly, soak the paper thoroughly in clean water, paste the edges to an inch in depth all around, taking particular care that they lie quite flat; leave a damp sponge in the centre of the paper until the edges are fixed.

When the paper is perfectly dry, *and not before*, you may begin the picture by lightly sketching in—if it be a landscape—the most distant objects, as mountains, hills, etc., with an H. B. pencil (never using charcoal for water-color work, as being liable to "work up" gritty and dirty), making your lines *bolder* and *stronger* as you approach the foreground. A *proper strength* of outline forms as much a part of good drawing as correct outline.

When satisfied with your sketch, gently soften it with stale bread crumbs, which as a means of erasure are far superior to rubber, neither injuring the paper's surface nor so dirty in use.

You will now proceed with a well-filled brush to wash in your deepest shadows with rich, warm colors, such as madder brown or burnt umber, being careful to keep them broad and clean; and remember that it is always better to begin too warm than too cool, for a warm color can easily be cooled, but a cold one can never successfuly be warmed,—besides, warm coloring is a recognized sign of a good colorist.

You next proceed, when the paper is again dry, to wash in the middle tints, such as are to be found in the foreground foliage and grasses, and the more positive tones of the middistance. You should not use such a full brush in this stage of the work, for the object now is to give more strength and form to the shadows, and draw in with the local coloring the various foreground objects. Again, while the color is drying, clean your palette and brushes, get a fresh supply of clean rain-water, and wash in carefully the large masses of sky and clouds. If a morning effect is desired, use Prussian or ultramarine blues for sky, and black India ink; Prussian blue and vermilion or madder lake for clouds.

The good colorist always endeavors to finish his sky in one painting; for here the manipulation of colors is so delicate a process that a misplacement would prove fatal to the successful completion of the picture.

Assuming that you have proceeded thus far satisfactorily, the picture now remains to be finished, and this is to be done in *one painting*.

If there are figures and animals in the foreground, as there should be, — for without them landscape would appear dull and void of interest, — finish them in a few broad and effective touches, melting into the background all hard lines, especially those of the lower extremities, so that your objects will not present the appearance of having been stencilled on. You cannot spend too much patience on the form and local color in foreground objects.

Take great pains to reproduce the exquisite tints of leaves, rock, and foliage that constitute the characteristics of landscapes. Be sparing in the use of positive colors: indeed, it would be profitable practice not to use any pure colors on your studies until you are better acquainted with their nature, but instead break all your tints, — *i. e.*, mix them together; by this means you will be less liable to create any jarring discord.

The distant mountains and hills should now be carefully finished up, working downward to mid-distance; then on the foreground objects, giving everything its proper strength and relation of color. Lastly, give figures and foliage their relative depths.

Now, in order to soften and blend the various colors and tones together harmoniously, and to give that misty effect peculiar to atmosphere, it will be necessary to go all over the picture with a few well-chosen tints.

The manner of applying these tints is that called "hatching," which consists in a series of little elongated touches or lines with a soft brush, leaving an interstice of a line's breadth between the touches, so that they may each be independent of the other. Begin in the upper left-hand corner with a delicate opal, and in working downward add a little ultra blue; at the horizon a little white must be added, with which you pass all over the distance, bringing it up with a little raw sienna to the mid-distance, working with a tint made of Prussian blue and raw sienna, only adding burnt sienna as you approach to the foreground. You may repeat this process three or four times, until you are satisfied with the harmony of your coloring. There will be several points in the work needing a few high lights and deep shades; the lights may now be given with Chinese white, and the shades with madder or Vandyke brown, with a little Prussian blue and burnt sienna.

Sketching from Nature. — When for the first time the student goes to nature for a subject for study or a picture, it frequently happens that he becomes disheartened and disgusted with his attempt to reproduce faithfully what he sees. He may be an excellent copyist of pictures, and a very capable draughtsman, yet he cannot sketch a piece of scenery from nature. In the first place, he generally anticipates too great success; in the next, he has no idea of arrangement, — that is, he sits down with the intent to copy things just as he sees them, a task he could never really accomplish. Could a man ever draw a tree or a field just as he saw it? We fear not. He draws the tree and field as nearly as he can conceive of their probable appearance, were they seen through a medium reducing them to the size of his drawing tablet.

When young artists leave town for the country, bent on a sketching expedition, it frequently happens that they leave all their most solid principles of study at home, and take nothing but haste and their acquired dexterity with them. To find a subject and draw it as quickly as possible is their great object. The desire should be to record with historic exactness the scene, or rather the peculiarities of the scene, selected.

It is not necessary to sketch all that one sees; indeed, the less the amount drawn, the greater will be the probability of effective and truthful representations. If a whole day be spent in making one small sketch artistically and truthfully, more benefit, in every sense, will be derived than by making a dozen merely passable sketches.

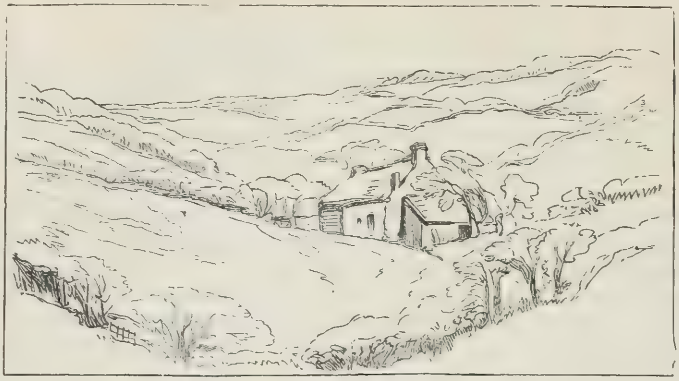


FIG. 52.

Suppose one selects a cottage as the subject for his sketch, and attempts to make his drawing from such a position as he must have occupied in producing Fig. 52; he may spend weeks and months on the drawing, yet never make it interesting or artistic. Now, if you walk over the field to within a few yards of the cottage and make a drawing in like manner to Fig. 53, you will find but one eighth the labor necessary to produce it, and the result will be more pleasing, artistic, and truthful. This matter of selection was mentioned in the foregoing pages on model drawing, and you see here its application and importance exemplified.

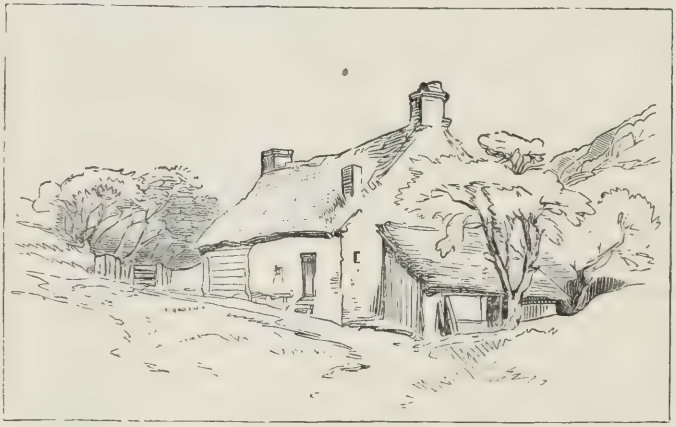


FIG. 53.

To sketch the cottage you must employ almost the same means that you did in drawing the pitcher, etc., making a very light outline; then instead of making a fine and correct outline, as you would were you drawing an object of the same texture and substance throughout, add a few effective lines or a little local color to give the various contours and characteristics of the subject. The less labor spent in making a sketch, the more effective will be the result. Mind, we do not say the less *time;* but the fewer the lines or touches employed judiciously, the more artistic and truthful will the drawing be.

The object of the sketch should be to suggest rather than to realize; for whatever be the style of execution or scale of finish adopted, the result must fall far short of the truth. Infinity is stamped upon every portion of nature, — an infinity utterly beyond the power of the eye to follow, or the hand to imitate, — so that the highest amount of artistic finish must of necessity be imperfect. The power of the hand is so restricted that it is impossible for it to place on paper all that the eye detects, even in the most simple surface; therefore, of the multitude of shades and shapes of which an object is composed, a selection must be made of those markings which best express its character.

After the best view of an object or group has been found, a difficulty presents itself to the student, and he becomes a little troubled as to where he can place it to the most advantage on the paper. To aid him in forming a good judgment on this query, he should get a large piece of white paper, and cut a square space from it the size he wishes to reproduce the scene; then, by holding it before him, near or at a distance from his eyes, he will readily perceive its various arrangements, one of which is better suited for an artistic reproduction than the others, and this should be adopted for the sketch.

Generally speaking, the most agreeable effects are produced when the interest of the subject lies rather under the half of the paper, leaving more room for sky above than for ground below; but circumstances so alter cases that no arbitrary rules can be given.

It may be well to caution the student against selecting any object in which the position of its windows or doors, or any of its parts, may suggest the features of a countenance.

It sometimes happens that after the artist has selected his position to the best advantage, the points of interest still lie too far apart to satisfy his desire for the picturesque; his method of proceeding, which is almost an unconscious one, is to draw them together by shortening their distances apart,— not by omitting the details, but by suppressing their size.

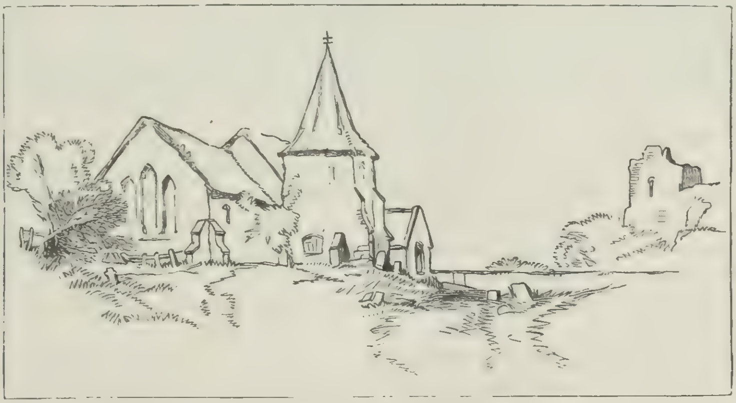


Fig 54.

For instance, in Fig. 54 you can see an illustration of our meaning. The outline of a scene is presented in which an object possessing considerable interest lies too much to the right to combine effectively with the chief point of attraction. By shortening the intervening space this unsatisfactory circumstance is avoided, and in Fig. 55 the ruin figures in pleasant connection with the rest of the picture. In both we have the church, trees, and tower, and anybody who knew the place would as readily recognize the truth of the second drawing as the first, without being aware that any change had been made; though it might be remarked, "I have often looked at that view, but never thought it would make such a good picture."

By this means the artist is enabled to introduce into the picture that which otherwise must have been omitted. But while commending the practice of condensation, it should be borne in mind in the distribution of points of interest that their effect depends upon *intermediate spaces of rest*, and that a subject may be deprived both of its truthfulness and repose by an undue exercise of the power of condensation and selection. It should also be remembered that the desire to eliminate whatever is weak, or condense whatever is scattered, may lead to fastidiousness in selection, or over-refinement in arrangement, both equally detrimental to that truthful and natural impression which it should be the aim of every student to produce.

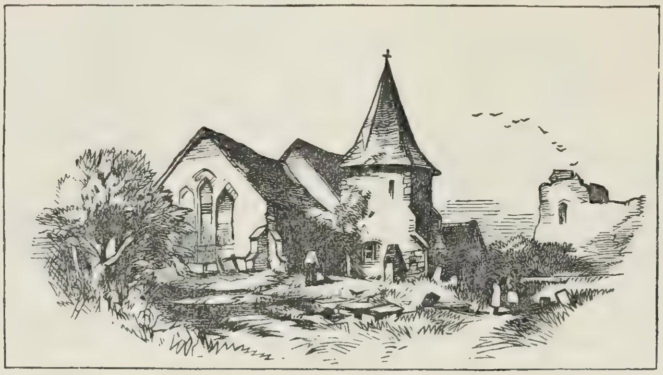
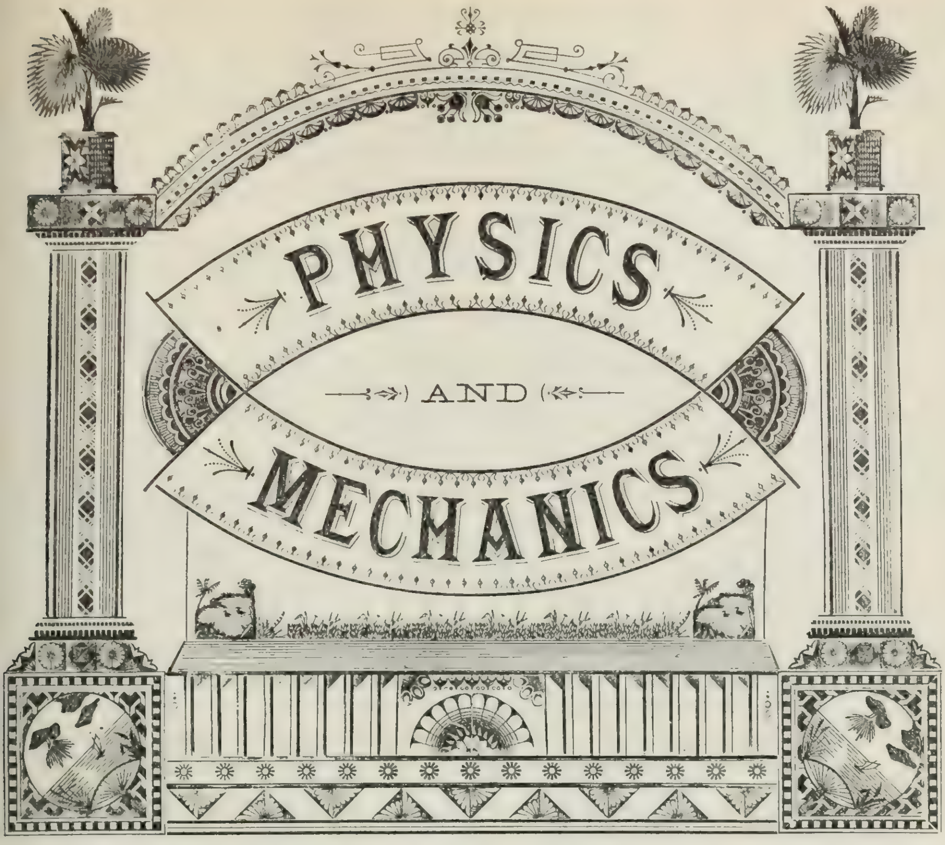


FIG. 55.

A few hints here on portrait and figure painting may prove useful to the beginner. After securing a correct outline, wash the paper all over with water lightly tinged with Indian yellow, while it is yet damp, lay in the darkest shadows with Venetian or Indian red, qualified with raw umber. When the paper is dry, proceed to mark in with Venetian red and vermilion the features, and if the subject is a figure, the position of the muscles, etc.; then with a very delicate tint of vermilion go lightly, and with a large brush, all over the drawing. Lay in the masses of light hair with raw sienna and burnt umber, and dark hair with indigo, lake, and black. Mark in the folds of drapery, using raw sienna, ultramarine blue, and black for white; Indian red and burnt umber for red; black and Prussian blue for blue; and indigo and lake for black. It is essential in this, the second stage, to give every object to be introduced its primary dead coloring. Supposing this to have been done, set the following palette: —

Flesh tint — Indian yellow and vermilion; *carnation tint* — madder, lake, and vermilion; *half tones or shades* — ultramarine, raw sienna, and vermilion; *deep shades* — raw umber and Venetian red. These, with the addition of Chinese white, ivory black, and sometimes cobalt blue, are all the colors necessary in figure painting. From this stage they are to be applied only through the process of hatching, lest by washing you disturb the first "layers," and thus produce what is technically called "muddiness."

So, taking great care to make your touches even and soft, at a regular distance apart, you may begin with the flesh tint on the forehead, working well up into the hair with the half-tone, thence downward, modelling the features with these two tints alone; next work in the carnations, and then the deep shades and shadows, using for the marking of the nostrils, lips, and eyes, madder, lake, and Venetian red. To give solidity to the lights, and, by contrast, transparency to the shadows, they may be heightened by Chinese white, vermilion, and Indian yellow, used very carefully.



PHYSICS AND MECHANICS

1. *PHYSICS*, or *NATURAL PHILOSOPHY*, is the science which treats of the phenomena presented to us by bodies.

2. A *body*, in physics, means a definite or determinate portion of *matter*, existing either in a solid, liquid, or aeriform state.

3. *Matter* is whatever occupies space, or whatever can be perceived by the senses.

A *simple* body consists of only one element of matter, as silver. A *compound* body consists of two or more elements in chemical union or mechanical mixture, as water, air.

A *compound body* must be distinguished from a *compound substance*, the term *body* properly belonging to physics, while the term *substance* is properly a term of chemistry.

A *compound substance* should only refer to one formed by *chemical union*, and not to a *mechanical mixture.*

4. Physics has for its object not only the study of the physical properties of *matter*, but also the study of the *forces* acting upon it.

The application of these forces may be considered under the following designations, viz.: —

Mechanics, Electricity, Magnetism, and Meteorology.

5. *MECHANICS* treats of the application of forces to machinery. It includes the study of —

Liquids at rest,	*Hydrostatics;*	The laws of heat,	*Pyronomics;*
Liquids in motion,	*Hydraulics;*	Light and vision,	*Optics;*
Gases and vapors,	*Pneumatics;*	Sound,	*Acoustics.*

6. *ELECTRICITY* is a kind of motion in matter. It includes—

That form of motion developed by chemical action, *Galvanism;*
That developed by heat, *Thermo-electricity;*
That developed by magnetism, *Magneto-electricity.*

7. *MAGNETISM* treats of the forces developed by magnets, and includes that developed by electricity, *Electro-magnetism.*

8. *METEOROLOGY* treats of the phenomena, or appearances, produced in the atmosphere.

GENERAL PROPERTIES OF BODIES.

9. By *properties*, as a term applied to bodies, we mean the different ways in which bodies are presented to our senses.

We distinguish them as *general* and *specific*, because the former are shared by all bodies, while the latter are observed in certain bodies only, or in certain conditions of these bodies.

The *general* properties are —

Magnitude or *extension*, *compressibility*, *expansibility*, *impenetrability*, *divisibility*, *porosity*, *inertia*, and *mobility*.

10. *EXTENSION* is the property of occupying space. The *size* of a body is the quantity of space it occupies; the *figure* is its form or shape.

11. *IMPENETRABILITY* is that property which prevents two separate bodies from occupying the same space at the same time.

A nail driven into a piece of wood merely displaces the particles, and does not penetrate them. Strictly speaking, this property belongs to atoms, not to bodies in bulk.

12. *DIVISIBILITY* is the property a body possesses of separation into parts.

The matter of which bodies are made is not continuous, but is an aggregation of very small portions called molecules, and these molecules are formed by a union of two or more atoms. (Here we reach the province of chemistry.) *Physics* deals with the *molecular forces*, but not with *ultimate particles* or *atoms*.

13. *POROSITY* is the property of bodies which permits only a partial union of the particles of matter composing them.

14. *COMPRESSIBILITY* and *EXPANSIBILITY* naturally result from porosity; for, as the particles of bodies are not everywhere in contact, a proper application of force can separate them further apart, or bring them nearer together, as is the case in heating and hammering iron.

15. *INERTIA* signifies the inability of a body to change its state.

16. *MOBILITY* renders the moving of a body possible, but is not, strictly speaking, a property.

INTERNAL OR MOLECULAR FORCES.

17. *Molecular* force is one that acts upon particles of matter only at very minute distances.

18. Every change which can happen to a body, excepting that which alters its chemical constitution, is a *physical phenomenon*.

19. The constant relation existing between any phenomenon and its cause is a *physical law*. For instance, the diminution of the volume of a gas by pressure discloses the law that "*the volume of a gas is inversely proportional to the pressure.*"

In ascending from a phenomenon to its cause, we assume the existence of physical agents, or natural forces, acting upon matter, and we find these forces in the specific properties of matter.

20. The primary properties we call *attraction* and *repulsion*. Both act at minute distances; the one tending to bring the particles of bodies closer together, the other tending to separate them.

The three kinds of attraction, acting at insensible distances, are called *cohesion*, *adhesion*, and *affinity*.

21. *COHESION* binds together similar molecules to form a uniform mass, as gold, water.

22. *ADHESION* causes unlike particles, or different bodies, to hold together when in contact, as smooth surfaces or liquids in small tubes.

23. *AFFINITY* is a chemical union of elements of different kinds to form a compound which is usually entirely unlike the elements.

A body will depend for its *form*, whether solid or liquid or gaseous, upon the relative power of the forces of attraction and repulsion among its particles.

The strength of cohesive attraction varies in different substances according to the nature, form, and arrangement of their molecules; and the modification of these molecular forces results in certain important properties in bodies, which have been heretofore mentioned as *specific properties of matter:* they are designated as follows; viz., *malleability*, *ductility*, *elasticity*, *tenacity*, *hardness*, and *brittleness*.

24. *MALLEABILITY* renders a substance capable of reduction to the form of thin leaves by hammering or rolling.

This property is possessed in the highest degree by metals; and gold may be rolled into such thin leaves that 290,000 will only equal an inch in thickness.

25. *DUCTILITY* renders a substance capable of being drawn into wire. Malleability and ductility are not always properties of the same substance.

Tin and lead can be hammered into very thin leaves, but cannot be drawn into fine wire. But an ounce of the finest gold wire would extend fifty miles.

RATIO OF THE DUCTILITY AND MALLEABILITY OF METALS.

In the order of wire-drawing ductility.	In the order of laminable ductility.	In the order of wire-drawing ductility.	In the order of laminable ductility.	In the order of wire-drawing ductility.	In the order of laminable ductility.
Gold.	Iron.	Tin.	Gold.	Tin.	Zinc
Silver.	Copper.	Lead.	Silver.	Platinum.	Iron.
Platinum.	Zinc.	Nickel.	Copper.	Lead.	Nickel.

The relative resistance of wrought iron and copper to tension and compression is as 100 to 54.5.

26. *BRITTLENESS* is a property which causes bodies to be easily broken, and it is a characteristic of most hard substances, as glass.

27. *HARDNESS* is a property of matter by which a body resists the action of any force which tends to separate its particles by penetration.

The harder of two substances will scratch the surface of the other. The diamond is the hardest of all bodies. The ruby, sapphire, topaz, and emerald follow in order.

The following table shows the relative hardness of the wood of our forest trees, taking shellbark hickory as the highest standard: —

Shellbark Hickory	100	Red Oak	69	White Elm	58
White Oak	84	White Beach	65	Chestnut	52
White Ash	77	Black Walnut	65	Yellow Poplar	51
White Hazel	72	Black Birch	62	Butternut	43
Apple Tree	70	Rock Maple	56	White Pine	30

The usual scale of hardness is, — 1, Talc; 2, Rocksalt; 3, Calc spar; 4, Fluor spar; 5, Apatite; 6, Felspar; 7, Quartz; 8, Topaz; 9, Corundum; 10, Diamond.

This scale of hardness may be used to determine the relative hardness of natural substances, and of substances artificially hardened by tempering or by alloy.

28. Hard substances, as most metals, glass, etc., may be rendered soft and flexible by heating and gradually cooling, and the process is called *annealing*.

29. Different pieces of iron or platinum, when heated to a high temperature, may be made to cohere by hammering, and the process is called *welding*.

These processes are of great importance in the arts, in fashioning and shaping instruments and machinery of all kinds.

30. By sudden cooling after heating, substances, especially and chiefly steel, are hardened; this process is called *tempering*. The degree of hardness as well as tenacity depends upon the degree of heat and the suddenness of cooling.

The reason of this is found in the principle of molecular attraction. The particles of the metal are separated by heat (that is, very rapid motion), and have not time to arrange themselves as before, on account of sudden cooling by plunging in water or oil.

31. The lineal expansion of metals, resulting from the raising of their temperature from the freezing to the boiling point (32° to 212° Fahr.), is shown in the following table: —

Faraday.				Faraday.			
Brass	1	part in	523	Platinum	1	part in	1053
Cast Iron	1	" "	901	Steel	1	" "	840
Copper	1	" "	571	Silver	1	" "	497
Glass	1	" "	1176	Tin	1	" "	500
Gold	1	" "	667	Wrought Iron	1	" "	794
Lead	1	" "	352	Zinc	1	" "	340

Ganot and Mathiessen give coefficients lower, and Rankine gives coefficients somewhat higher, than Faraday.

Expansion in volume would be three times the lineal expansion.

Certain increments, so small as not to affect the result within ten millionths of a unit, would need to be added to make the expansion in bulk exact, but they are needless for practice.

32. Steel is the metal most frequently subjected to this process of tempering; and although there are many methods of dealing with it, the most philosophical, and that which gives the best results, is the one which produces the least expansion of the particles necessary to effect this rearrangement, and it is accomplished by fire and water simply.

33. The degree of heat proper to be used in each case can only be determined by experience and good eyesight; but the formula in use for general guidance is as follows: —

Surface Color of Steel produced by Heat.	Temperature.	ARTICLES.
A very pale Straw.	430°	Lancets. } Hammer faces, etc.
Straw.	450°	Razors.
Yellow.	470°	Tools, Pen-knives.
Brown.	490°	Tools with hard edges, without elasticity.
Brown with purple spots.	500°	Plane-irons, knives, chisels. All kinds of wood-tools and soft metals.
Purple.	538°	
Dark Blue.	550°	Tools requiring strong edges, but not of extreme hardness.
Full Blue.	560°	Cold-chisels, axes, etc.
Dark Blue.	600°	Spring temper, bend without breaking, saws and swords.

A higher degree of heat destroys the effect of the hardening process.

34. *Steel* is carbonized iron, in which the carbon is from 1 to 5 per cent. It can be distinguished from iron by its fine grain, and by the black spot produced by a drop of nitric acid; upon iron, the spot resulting from nitric acid would be of a lighter color.

35. *Wrought iron* becomes steel by a process called *cementation.* The best iron is heated with charcoal, and a portion of carbon is absorbed; and the iron acquires a blistered surface, and becomes fine-grained and fusible. The best Russian or Swedish iron is used to make the finest steel. The best wrought iron is almost entirely free from carbon; hence the manufacturer of steel can produce it with just such a proportion of carbon as will make it best for the particular use for which it is to be employed. Consequently, when the consumer orders from the manufacturer, he should state the use to be made of the steel, that he may be sure to receive the kind best adapted to the purpose, and that he may know how it should be treated in tempering.

36. We believe the following to be a list of the most useful *tempers* of cast steel: —

Razor temper ($1\frac{1}{2}$ per cent carbon). — This steel is so easily burnt by being overheated that it can only be placed in the hands of a very skilful workman. When properly treated, it will do twice the work of ordinary tool steel for turning chilled rolls, etc.

Saw-file temper ($1\frac{3}{8}$ per cent carbon). — This steel requires careful treatment, and, although it will stand more fire than the preceding temper, should not be heated above a cherry-red.

Tool temper ($1\frac{1}{4}$ per cent carbon). — The most useful temper for turning-tools, drills, and planing-machine tools in the hands of ordinary workmen. It is possible to weld cast steel of this temper, but not without care and skill.

Spindle temper ($1\frac{1}{8}$ per cent carbon). — A very useful temper for mill-picks, circular cutters, very large turning-tools, taps, screwing-dies, etc. This temper requires considerable care in welding.

Chisel temper (1 per cent carbon). — An extremely useful temper, combining, as it does, great toughness in the unhardened state with the capacity of hardening at a low heat. It may also be welded without much difficulty. It is consequently well adapted for tools, where the unhardened part is required to stand the blow of a hammer without snapping, but where a hard-cutting edge is required, as in cold-chisels.

Set temper ($\frac{7}{8}$ per cent carbon). — This temper is adapted for tools where the chief punishment is on the unhardened part, such as cold-sets, which have to stand the blows of a very heavy hammer.

Die temper ($\frac{3}{4}$ per cent carbon). — The most suitable temper for tools where the surface only is required to be hard, and where the capacity to stand great pressure is of importance, such as stamping or pressing dies, boiler cups, etc. Both the last two tempers may be easily welded by a mechanic accustomed to weld cast steel.

37. *Case-hardening* consists in converting the surface of wrought iron into steel to enable it to receive polish or bear friction, and is effected by heating the iron in a close vessel, in contact with carbonaceous materials, as leather, hoofs and horns, until the scales of oxide loosen, and then plunging it in cold water.

Cast iron may be case-hardened by raising its temperature until it is red hot, and then rolling it in a composition of equal parts of prussiate of potash, sal-ammoniac, and saltpetre, pulverized and thoroughly mixed; then plunging it while hot into a bath containing two ounces prussiate of potash and four ounces sal-ammoniac to each gallon of cold water.

38. *To temper small springs in large quantities.* — First harden them in the usual manner of hardening steel, then place as many as convenient in a vessel containing oil; heat the oil until it takes fire on the top, then set aside the vessel until cold, and the springs will possess the required temper.

There are many recipes for tempering steel articles, but the simple process of heating in charcoal fire and cooling in spring water seems to produce the best results. Mr. N. B. Ames, after many costly experiments, found this method of heating and hardening, and drawing the temper in charcoal flame, produced swords and cutlasses that would best sustain the United States government test.

Oils and various mixtures are used in tempering; but are not so good as pure water, unless the steel has been overheated.

Burnt steel may be quickly restored by plunging while hot in cold water and hammering it lightly on the anvil, turning it so as to hammer every portion of it, and again repeating the process.

39. *To test the quality of steel.* — Good tool-steel, with a white heat, will fall in pieces; with bright-red heat, will crumble under the hammer; with middling heat, may be drawn to a needle-point. It should be dull silver color, uniform and entirely free from sparkling qualities. Its excellence will be proportional to its tenacity in hard state. The "hardening heat" varies with each temper of steel, and the only safe course is to harden at the lowest possible heat, and this must be found by trial; it is better to err, if at all, on the safe side. *Cherry-red* is a safe heat. "*Soaking*," or long-continued heat, is injurious. *Fluxes* are not necessary; for success in annealing and hardening depends upon properly heating and cooling, not, as many believe, upon some particular method; and this fact has been thoroughly established by the numerous experiments of scientific and practical steel-workers. However, some of the best methods of using fluxes are given herein.

40. *Hot shortness*, or brittleness when hot, is generally the result of the presence of sulphur.

41. *Cold shortness*, or brittleness when cold, results from the presence of phosphorus.

Tilted steel is made from *blistered* steel when moderately heated by drawing it into smaller bars, and subjecting it to the action of a tilt hammer, thus increasing its tenacity and density.

42. *Shear* steel is made by breaking up, heating, welding, and drawing out blistered steel, and repeating the operation several times to produce the finest kind.

43. *Cast* steel is made by breaking up *blistered* steel, and melting it in close crucibles and pouring it into iron moulds. It is then hammered or rolled into bars. This kind of steel is best adapted to general purposes. Much hammering or jarring causes the molecules of a metal to assume a new arrangement and become brittle; and it can only be brought back into a proper state for working by annealing, which can be accomplished by raising its temperature to a low red heat.

An excellent composition for welding cast steel is made by boiling together sixteen parts of borax and one of sal-ammoniac over a slow fire for one hour; when cold, grind it to powder, and use it as sand upon the heated steel.

Finely tempered steel possesses great elasticity and tenacity; and some sword-blades may be bent into a circle and perfectly regain their original position.

ELASTICITY AND TENACITY.

44. *ELASTICITY* is that property of matter which causes bodies to resume their original form when external force is removed. This is exhibited in the rebound of a rubber ball, or the recoil of a steel spring.

45. *TENACITY* is the property by which a body resists separation of its parts. In its ordinary sense it is resistance to traction, or drawing out lengthwise.

Relative tenacity is resistance to fracture; *reactive* tenacity is resistance to crushing; *sheering* tenacity is resistance in a lateral direction or sideways; and *tortional* tenacity is resistance to twisting.

Tenacity is directly proportional to the breaking weight, and inversely proportional to the area of a transverse or cross section of the wire.

Tenacity diminishes with the duration of the traction (or the length of time the stretching force is applied), and it varies with the form of the body. With the same sectional area, a cylinder has greater tenacity than a prism.

The quantity of matter being the same, a hollow cylinder has greater tenacity than a solid one; and the tenacity of a hollow cylinder is greatest when the external radius is to the internal one in the ratio of 11 to 5.

46. The *ultimate strength* of a body is the load or weight necessary to produce fracture.

47. The *proof strength* is the weight which produces the greatest strain of a specific kind consistent with safety.

48. A *dead load* is one put on by degrees, as the weight of a structure. A *live load* is one put on suddenly and accompanied by vibration, as a swiftly moving train on a bridge.

The *mean* intensity of a *live* load is no greater than of a *dead* load, but in most cases a live load will produce twice the effect of a dead load in stress and strain: hence the *real* factor of safety is much less than the apparent one; and the working load should be only one fourth or one third the apparent factor.

49. The *elasticity of a solid* consists in its resistance to change of figure, and the power of regaining its original form when the straining force is withdrawn.

No solid substance is perfectly elastic, but many are sensibly so when the force applied does not exceed the *proof strength.*

50. The *resilience* of a body is the quantity of work required to produce the *proof stress* on a given piece of material, and equals the product of the "proof strain," or alteration of figure, by the mean load used in the production of that strain.

51. The *modulus* or *coefficient of elasticity* of any substance is the measure of its resisting or elastic force; it is, in other words, a quantity representing the weight in pounds which, applied to the end of a bar, would elongate it by its own length if the bar were perfectly elastic.

For example, suppose one inch in length of a bar of iron, whose cross section is an inch square, be extended by a weight of one pound .000,000,056, or fifty-six billionths, of its length, then this decimal would be the coefficient of elasticity. But as it is inconvenient to use such large decimals, their reciprocal is used; that is, in this case, 1 ÷ .000,000,056 = 17,857,143, which is the modulus of elasticity, and represents the weight in pounds which would double the length of the bar if it were perfectly elastic.

52. The *height* of a *modulus of elasticity* of a body is the length of an imaginary vertical column of the same material, whose weight would cause a pressure on its base equal in intensity to the stress expressed by the given modulus.

To compute the height in feet of a modulus of elasticity, — divide the weight of the modulus in pounds by the weight of twelve cubic inches of the material.

To compute the weight of a modulus of elasticity of a substance. RULE. — As the amount of the extension or compression of the length of a given substance is to its length in inches, so is the force or weight in pounds that produced such change to the modulus of its elasticity in pounds.

EXAMPLE. — If a bar of iron one inch square and ten feet long be increased in length .006 of an inch by a weight of 1,000 pounds, what will be the modulus of elasticity? *Operation.* .006 : 120 (the length in inches) :: 1,000 : 20,000,000 pounds, answer.

THE HEIGHT AND WEIGHT OF THE MODULUS OF ELASTICITY OF VARIOUS SUBSTANCES.

MATERIAL.	Weight in Lbs.	Height in Feet.	MATERIAL.	Weight in Lbs.	Height in Feet.
Iron, cast	17,968,500	5,750,000	Zinc	13,440,000	4,480,000
" wrought	25,820,000	7,550,000	Ash	1,656,670	4,970,000
" wire	28,230,500	8,337,000	Elm	1,499,500	5,680,000
Steel, cast	26,650,000	8,530,000	Oak	1,710,000	4,750,000
" wire	28,689,000	9,000,000	Pine, pitch	2,430,000	8,700,000
Copper, cast	18,240,000	4,800,000	" white	1,830,000	8,970,000

53. It is important in building, and in the arts generally, to know the relative elasticity and tenacity of the materials used, and we therefore give tables here showing the results of experiments made by the best scientists and artisans. The results will naturally vary, as the same kinds of substances vary in texture and composition, but they can be depended upon within the limits given.

54. *Tensile* strength is the amount of force with which the fibres or particles of a body resist separation, and is in proportion to the number of its fibres, or to the area of its transverse or cross section.

TABLE SHOWING THE TENACITY OR RESISTANCE TO TEARING OF MATERIALS IN POUNDS PER SQUARE INCH.

RANKINE AND OTHERS.

MATERIALS.		LBS.		LBS.
Brass, cast	From	18,000	to	......
“ wire	“	49,000	“	......
Copper, cast	“	19,000	“	......
“ cast, American	“	24,250	“	......
“ bolts	“	36,000	“	......
Iron, cast	“	13,400	“	29,000
“ cast, American mean.	“	39,000	“	......
“ “ “ wire	“	70,000	“	100,000
“ “ “ “ ropes.	“	90,000	“	......
“ wrought plates	“	51,000	“	......
“ Swedish bar	“	72,000	“	......
Russian bar	“	59,500	“	......
Lead, sheet	“	3,300	“	......
“ cast	“	1,800	“	......
Steel, cast, bars	“	100,000	“	130,000
“ plates	“	80,000	“	96,000
“ Am. Tool Co	“	179,980	“	.....*
Silver, cast	“	40,000	“	......
Platinum, wire	“	53,000	“	......
Tin, cast	“	4,600	“	5,000
Zinc	“	7,000	“	8,000
Bronze	“	36,000	“	73,000
Brick, well burnt	“	750	“	......
“ ordinary	“	100	“	300
Cement, Portland, 6 mos.	“	414	“	......
“ “ 1, sand 3	“	380	“	......
“ hydraulic	“	200	“	300

RANKINE AND OTHERS.

MATERIALS.		LBS.		LBS.
Ash	From	1,400	to	......
“ English	“	17,000	“	......
Beech	“	11,500	“	......
Chestnut	“	10,500	“	13,000
Lignum-vitæ	“	11,800	“	......
Mahogany	“	21,000	“	......
Oak, Am. white	“	11,500	“	......
“ European	“	10,000	“	19,000
Pine, pitch	“	12,000	“	......
“ white	“	11,800	“	......
Glass	“	9,400	“	......
Slate	“	9,600	“	12,800
Leather belts	“	330	“	......
Marble, Italian	“	5,200	“	......
“ white	“	9,000	“	......
Sycamore	“	13,000	“	......
Larch	“	9,000	“	10,000
Box	“	20,000	“	......
Cedar	“	11,400	“	......
Elm	“	13,400	“	......
Locust	“	20,500	“	......
Lance	“	23,000	“	......
Pear	“	9,800	“	......
Poplar	“	7,000	“	......
Spruce	“	10,200	“	12,400
Teak	“	14,000	“	15,000
Walnut	“	7,800	“	......
Willow	“	13,000	“	......

* Experiments of United States Ordnance Department.

Steel manufactured by the American Tool Company has greater tenacity than the best English steel. The *working* tenacity or *load* is generally ⅙ the amount given in the table, which represents the *ultimate tenacity* or *breaking load.*

55. The *transverse strength* of any bar, beam, rod, etc., is proportional to the product of its breadth by the square of its depth; hence, in square beams or bars, it is as the cube of the side, and in cylinders as the cube of the diameter of the section.

The strength of a beam or bar, *fixed at one end only*, decreases as the distance of the weight from the section acted upon increases, and increases as the distance decreases.

When *both ends* of *a beam* or *bar are fixed*, and the weight is applied in the centre, the strength is six times greater for an equal length than if only one end is fixed.

The strength of a beam or bar whose ends *merely rest on supports*, as compared with one whose ends are fixed, the weight being supported in the middle, is as 2 to 3.

Twice the weight can be supported, when uniformly distributed, that can be sustained at one end or in the middle.

The less the dimension of the side of a metal bar, or the diameter of a metal cylinder, the greater its proportional transverse strength, because of the greater proportion of hammered surface compared to the elements of strength resulting from the increased dimensions.

The *deflection* of a bar or beam by a cross-strain compresses the concave surface and extends the convex surface, and is directly as the cube of the length, and *inversely* as the product of the breadth by the cube of the depth.

TRANSVERSE STRENGTH,

Or Resistance of Materials to Breaking Across, — deduced from Experiments by Clay, Hodgkinson, Napier, Morin, Tetford, Fairbairn, Rankine, and Wade, — in Pounds per Square Inch.

When a Bar One Inch Square is supported at Two Points One Foot apart and loaded in the Middle.

MATERIALS.	Breaking Weight.	Working Load or Value for Use.	MATERIALS.	Breaking Weight.	Working Load or Value for Use.
Iron, cast......	From 1,833 to 2,416	From 611 to 805	Ash............	From 666 to 783	From 222 to 261
Steel, cast plates	" 3,838 " 5,406	" 1,279 " 1,802	Beech.........	" 500 " 666	" 166 " 222
Birch..	" 650 "	" 216 "	Elm	" 333 " 540	" 111 " 180
Spruce.........	" 550 " 683	" 183 " 228	Oak...........	" 550 " 755	" 185 " 251
Lignum-vitæ...	" 666 "	" 222 "	Teak..........	" 666 " 1,055	" 222 " 351

When One End is fixed and the Weight suspended from the other End.

MATERIALS.	Breaking Weight.	Value to Value.	MATERIALS.	Breaking Weight.	Value to Value.
Iron, cast, American...	From 507 to 772	From 125 to 225	Iron, wrought, American.................	From 600 to 700	From 160 to 200
Steel, greatest.........	" ... " 1,918	" 350 " 450	Iron, wrought, English,	" 400 " 665	" 165 " 210
Steel, puddled, permanent bend...........	" ... " 800	" 170 " 225	Copper...............	" ... " ...	" ... " 55
Ash...................	" 168 " ...	" ... " 55	Beech................	" 130 " ...	" ... " 32
Birch.................	" 160 " ...	" ... " 40	Chestnut..............	" 160 " ...	" ... " 53
Elm...................	" 125 " ...	" ... " 30	Hickory.............	" 250 " ...	" ... " 55
Locust................	" 295 " ...	" ... " 80	Maple................	" 202 " ...	" ... " 65
Oak...................	" 208 " 245	" 50 " 55	Pine, pitch...........	" 136 " 160	" 45 " 50
Teak..................	" 206 " ...	" ... " 60	Pine, white...........	" 92 " 130	" 30 " 45

Cast-iron square bar, breaking weight, 673. Cast-iron cylinder, breaking weight, 573.
Cast-iron hollow cylinder, greater diameter twice the lesser, 794.

56. *To compute the transverse strength of a rectangular beam or bar, of a cylinder, square, etc.:* —

Let T represent the working value for use.
" W " the weight to be sustained.
" l " the length in feet.
" b " the breadth, and
" h " the depth in inches.
" m " the distance in feet of the weight from one end, and
" n " the distance of it from the other end.

First. When a beam or bar is *fixed at one end and loaded at the other*, the formula will be $W = \frac{(b\,h^2)T}{l}$; that is, to find the strength of the bar, or the weight that can be sustained, multiply the *value* of the material (as found in the table, or otherwise) by the product of the breadth into the square of the depth in inches, and divide by the length in feet.

If the beam be loaded uniformly throughout its length, the result thus obtained must be doubled.

If the side dimensions of a beam or bar required to support a given weight at its end are wanted, transpose the above formula thus: $W = \frac{(b\,h^2)T}{l}$, or $\frac{W}{(b\,h^2)T} = \frac{1}{l}$, or $(b\,h^2)T = W\,l$, or $b\,h^2 = \frac{W\,l}{T}$, which is the equation required, and gives the product of the breadth and the square of the depth by dividing the product of the given weight and the length, in feet, of the beam by the value of the material. Supposing $b\ h^2 = 8$ in., then, if the breadth be 2 inches, the depth will be the square root of $4 = 2$ inches.

Secondly. When a beam or bar is *fixed at both ends and loaded in the middle*, the strength of the beam is six times that when it is fixed only at *one* end. Formula, $W = \frac{(6\ b\ h^2)T}{l}$. Formula for side dimensions, when loaded in the middle by a given weight, is $b\ h^2 = \frac{W\ l}{6\ T}$.

Thirdly. When a beam or bar is simply *supported* at the ends and loaded in the *middle*, its strength is four times that when it is *fixed at one end.* Formula, $W = \frac{(4\ b\ h^2)T}{l}$.

Formula for side dimension, when loaded in middle by a given weight, is $b\ h^2 = \frac{W\ l}{4\ T}$.

Fourthly. When a beam or bar is *supported* at both ends and the weight is *not* in the middle, the formula is $W = \frac{(l\ T)\ (b\ h^2)}{m\ n}$: that is, the weight that can be supported is found by multiplying the value of the material by the length of the beam in feet, and this product by the product of the breadth and square of the depth, and dividing the result by the product of the distances of the weight from either support.

If dimensions are required to support given weight, not in middle, formula is $b\ h^2 = \frac{m\ n\ W}{l\ T}$.

Fifthly. When a beam or bar is *fixed* at both ends and the weight is *not* in the middle, the weight sustained is 1.5 times that where the beam is only supported. Formula, $W = \frac{3\ (l\ T)\ (b\ h^2)}{2\ m\ n}$.

If dimensions are required to support a given weight not in the middle, the formula is $b\ h^2 = \frac{2\ m\ n\ W}{3\ l\ T}$.

Sixthly. When a cylinder, square, hollow cylinder, or beams having sections of an ellipse, are either fixed at one end and loaded at the other, or supported at both ends, the load applied in the middle or between the supports. RULE. — Proceed in all cases as for a rectangular beam, taking for the breadth and depth, and value of the material, as follows: In Cylinders, *cube of diameter* × .6; Square, *cube of side;* Hollow Cylinder (*cube of outside diameter — cube of inside diameter*) × .6; Ellipse, *transverse diameter vertical conjunction* × *transverse*^{2} × .6; and *conj. diam. vertical transverse* × *conj.*^{2} × .6 *of value.*

57. *Girders, beams, lintels, etc.* — The transverse strength of any girder, beam, breastsummer, lintel, etc., is in proportion to the product of its breadth and the square of its depth, and also to the area of its cross-section.

When girders are subjected to impulses and are used to sustain vibrating loads, as in bridges, the best proportion between the top and bottom flanges is 1 to 4.

About 175 pounds' supporting power per square foot of floor surface should be a sufficient provision for the weight of flooring and the load upon it in public halls, churches, etc., where the weight of people is to be provided for, and about 280 pounds per square foot for stores and factories.

In cases where the structure is exposed to sudden impulses, as bridges, the stress to be sustained should not exceed one sixth of the breaking weight.

58. To compute the dimensions and form of a girder or beam: — I. *When fixed at one end and loaded at the other:* —

1. When the depth is uniform throughout the entire length, the section at every point should be *in proportion to the product of the length, breadth, and square of the depth;* and as the depth is uniform, the *breadth must vary as the length.*

2. When the breadth is uniform, *the depth must vary as the square root of the length;* hence the upper or lower side, or both, must be determined by a parabolic curve.

3. When the section at every point is similar, — for a circle, *the diameter at every point must be as the cube root of the length;* and for an ellipse or a rectangle, *the breadth and depth must vary as the cube root of the length.*

II. When such a girder is loaded uniformly throughout its entire length: — 1. The depth being uniform, the *breadth must increase as the square of the length.*

2. When the *breadth* of the girder uniformly loaded is uniform, *the depth will vary as the length.*

III. When a girder or beam is supported at both ends and loaded in the middle: —

1. When the depth is uniform, *the breadth must be in the ratio of the length.*

2. When the breadth is uniform, *the depth will vary as the square root of the length.*

3. When the section at every point is similar, as a circle, square, etc., *the cube of the depth will be as the square of the distance from the supported end.*

59. Wooden girders or beams, when sawed in two or more pieces, with slips set between them and the whole bolted together, are made stiffer, and are less liable to decay.

Girders cast with the face up are said to be stronger than when cast on a side in the proportion of 1 to .96, and they are strongest when cast with the bottom flange up.

TRANSVERSE STRENGTH OF CAST-IRON GIRDERS AND BEAMS, DEDUCED FROM EXPERIMENTS BY BARLOW, HODGKINSON, HUGHES, TREDGOLD, ETC.

Reduced to a Uniform Measure of One Inch in Depth, One Foot in Length, supported at Both Ends, the Stress or Weight applied in the Middle.

SECTION OF GIRDER OR BEAM.	FLANGES.		Width of Vertical Web.	Depth of Girder.	Breadth of Girder.	Area of Section in Centre.	Breaking Wt. at Length of One Foot.	Strength per Square In. of Section.	*Value* for Br'king Weight = $\frac{l\,W}{A\,d} = T$.‡
	Top.	Bottom.							
	Sq. Inches.	Sq. Inches.	Inch.	Inch.	Inch.	Sq. Inch.	Pounds.	Pounds.	Pounds.
Equal area of flange at top and bottom,	1.75×.42 = .735	1.77×.39 = .69	.29	5.125	1.77	2.82	30150	10768	2100
do.	2.02×.515 = 1.045	2.02×.515 = 1.045	.51*	2.02	2.02	2.59	10276	3952	1900
Area of sec. of top and bottom, 1 to 6,	2.23×.31 = .72	6.67×.66 = .44	.266	5.125	6.67	6.23	117450	18852	3650
do. 3 to 1,	1.5×.5 = .75	.5×.5 = .25	.5	4.†	1.5	1.	7252	7252	1800
Rectangular Prism,	....	....	.994	2.012	.994	2.025	9440	4662	2350
Open beam,	1.005×.98	1.005×.98	1.005	2.51	1.005	1.98	12340	6232	2450
	.995×1	.995×1	.995	3.01	.995	2.	15420	7710	2550
	1.005×.98	1.005×.98	1.005	4.	1.005	1.98	21765	10992	2700
	.771×1.5	.771=1.5	.771	4.04	.771	2.322	25705	11070	2750
	1.507×.74	1.507×.74	1.507	4.04	1.507	2 23	25735	11540	2850
	1.525×.78	1.525×.78	1.525	4.07	1.525	2.35	30000	12689	3100
Square prism, stress at side,	....	....	1.02	1.01	1.02	1.03	2635	2552	2500
Cylinder,	....	....	1.122	1.122	1.122	.989	2370	2396	2150
Square prism, angle up,	....	....	.4431	1.443	1.443	1.041	2269	2182	1500

* Horizontal web.

† Depth of opening, three inches.

‡ A *representing area of section;* d, *the depth in inches;* l, *the length in feet;* W, *the breaking weight in pounds; and* T, *the tension or value for breaking weight.*

TRANSVERSE STRENGTH OF WROUGHT-IRON GIRDERS AND BEAMS, DEDUCED FROM EXPERIMENTS BY BARLOW, FAIRBAIRN, HUGHES, ETC.

Reduced to a Uniform Measure of One Inch in Depth, one Foot in Length, supported at both Ends; the Stress or Weight applied in the Middle.

Section of Girder or Beam.	Flanges.		Width of Vertical Web.	Depth of Girder.	Breadth of Girder.	Area of Section in Centre.	Breaking Weight at Length of one Foot.	Strength per Square Inch of Section.	Value for breaking Weight = $\frac{l\,W}{A\,d}$ = T.
	Top.	Bottom.							
	Sq. Inch.	Sq. Inch.	Inch.	Inch.	Inch.	Sq. Inch.	Pounds.	Pounds.	Pounds.
Equal area of flange at top and bottom, Solid,	2.5 × 1 = 2.5	4 × .38 = 1.52	.325	8.38	4.	6.295	132000	20952	2500
Area of section of top and bottom, 1 to 4, Solid,	....	3.5 × .6 = 2.1	.8	3.5	3.5	6.25	49280	7822	2200
Equal areas top and bottom, Riv'd,	2.86× .33 = .944	2.86× .33 = .944	66	3.7	2.86	3.88	56000	14433	3800
“ “	2 of 3.5 × 3.5 × .5 = 7	2 of 3.5 × 3.5 × .5 = 7	.37	16.	7.37	19.92	768000	38593	2400
	2 of 2.125× .28 = 1.19	2 of 2.125× .30 = 1.27	25	7.	4.5	4.26	170660	40345	5800
			Thick. of Plates.						
Hollow Rectangle, “	....	....	.061	3.	1.95	.6	9450	15750	5200
	....	....	.1325	6.	4.	2.62	75600	28855	4700
	....	....	.124	24.	15.	9.6	375000	39063	1600
	....	....	.525	24.	16.	41.45	3864000	93221	3900
	....	....	.75	36.	24.	87.75	4310400	149333	4900
Hollow Square, “	9.6 ×.25 = 2.419	9.6 ×.075 = .72	.074	9.5	9.5	4.36	146528	33607	3450
	2.25 ×.26 = .585	2.25 ×.26 = .585	.131	15.	2.25	5.1	452400	88706	5500
	1 × .28 = .282	1 × .116 = .116	.067	8.	1.	1.47	123794	84214	10300
Ellip.*	....	....	.375 t. .25 b. .125 s.	24.	16.	12.94	188160	14540	6050
Tubes,	....	....	.143	15.	9.75	5.56	278250	50045	3300
	....	....	.0408	12.	12.	1.4	44200	31571	2600
	....	....	.095	24.	24.	7.13	298629	41743	1725

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* The lateral strength of this was ascertained to be 38080, or .613 of its vertical strength. The ultimate deflection was 2¾ inches.

CRUSHING STRENGTH.

60. The *crushing* strength of any body is in proportion to the area of its section, and inversely as its height.

The strength is determined by the least diameter when the column is not uniform, and it is at its maximum when the height of a column is less than 5 times its side or diameter.

Mr. Hodgkinson has determined by experiment that, by enlarging the diameter of a column of cast iron in its middle, an increase of strength of about ⅛ of the breaking weight is obtained.

A wrought-iron bar can be compressed $\frac{1}{863}$ of its length without destroying its utillty.

CRUSHING STRENGTH OF VARIOUS METALS.

Deductions by Hodgkinson, Rankine, and Major Wade. Uniform Measure of One Square Inch.

Materials.	Crushing Weight.	Crushing Weight.	Materials.	Crushing Weight.	Crushing Weight.
	LBS.	LBS.		LBS.	LBS.
Cast iron (American gun metal)	from	to 174,803	Brass, fine	from	to 164,800
Cast iron, American, mean	“	“ 129,000	Copper, cast	“	“ 117,000
“ “ English (various qualities)	“ 82,000	“ 145,000	Steel	“	“ 295,000
Cast iron, average	“	“ 112,000	Tin	“	“ 155,000
Wrought iron, English	“ 36,000	“ 65,000	Lead	“	“ 7,730
“ “ American	“ 83,500	“ 127,000			
Brick, machine pressed	“ 6,222	“ 14,216	Limestone, English	“ 2,185	“ 7,300
“ common	“ 800	“ 4,000	Granite, “	“ 6,000	“ 10,000
“ masonry	“ 500	“ 800	“ Quincy	“	“ 15,300
Glass, crown	“	“ 31,000	Gneiss	“	“ 19,600
Marble, Italian	“	“ 12,624	Sandstone	“ 2,800	“ 10,762
“ American	“	“ 8,000			
Ash	“ 6,663	“ 9,000	Beech	“ 6,963	“ 9,360
Birch	“ 6,400	“ 7,969	Ebony, West Indian	“	“ 19,000
Box	“ 10,300	“ 10,513	Elm	“ 6,831	“ 10,200
Cedar	“ 5,860	“ 5,968	Hickory, white	“	“ 8,925
Locust	“	“ 9,113	Mahogany	“	“ 8,200
Maple	“	“ 8,150	Oak, American white	“	“ 6,100
Pine, pitch	“	“ 8,947	“ Canadian live	“	“ 6,850
“ white	“	“ 5,775	“ English	“ 6,484	“ 9,900
“ yellow	“	“ 8,200	Spruce, white	“	“ 5,950
Sycamore	“	“ 7,082	Teak	“	“ 12,100
Walnut	“	“ 6,645	Lignum-vitæ	“	“ 9,900

COMPARATIVE RESISTANCE OF CAST AND WROUGHT IRON BARS

To bear Compression in the Direction of their Length, set vertical, and enclosed in a Frame to maintain them in that Position.

[One Inch Square and Ten Feet in Length.]

DECREASE IN LENGTH.

Weight.	Cast Iron.	Wrought Iron.	Weight.	Cast Iron.	Wrought Iron.
5,054	.054	.028	27,498	.3	.143
9,578	.102	.052	31,978	.357	.174
14,058	.151	.073	40,938	.503	

61. To compute the crushing strength of a solid cylindrical column of cast iron. Hodgkinson's formula: —

$$\frac{d^{3 \cdot 6}}{l^{1 \cdot 7}} \times 100{,}000 = \mathrm{W}.$$

In which formula W *represents the crushing weight in pounds;*
d " *the diameter of the column in inches; and*
l " *its length in feet.*

Euler's formula for same is —

$$\frac{d^{4}}{l^{2}} \times 100{,}000 = \mathrm{W}.$$

Hodgkinson's formula for hollow cylinder: —

$$\frac{\mathrm{D}^{3 \cdot 6} - d^{3 \cdot 6}}{l^{1 \cdot 7}} \times 100{,}000 = \mathrm{W}.$$

D *represents greater diameter.*

Euler's for same is —

$$\frac{\mathrm{D}^{4} - d^{4}}{l^{2}} = \mathrm{W}.$$

62. — WEIGHT, IN 1,000 POUNDS, THAT CAN BE BORNE WITH SAFETY BY CAST-IRON COLUMNS. (*Trenton Iron Company.*)

1. LENGTH. FEET.	2. Ins.	3. Ins.	4. Ins.	5. Ins.	6. Ins.	7. Ins.	8. Ins.	9. Ins.	10. Ins.	11. Ins.	12. Ins.	13. Ins.	14. Ins.	15. Ins.
5	12.4	44	102	184	288	414	560	728	916	1,126	1,354	....	....	....
6	9.4	36	88	164	264	386	532	698	884	1,082	1,320	1,570	....	....
7	7.2	30	76	146	242	360	502	660	850	1,056	1,282	1,530	1,798	2,086
8	....	24	66	130	218	332	470	630	812	1,016	1,240	1,486	1,754	2.040
9	....	20	56	114	198	306	440	596	774	974	1,196	1,440	1,706	1,992
10	....	18	48	102	180	282	410	560	739	932	1,152	1,392	1,656	1,940
12	....	....	38	80	136	238	354	494	658	846	1,056	1,292	1,550	1,828
14	....	....	28	64	122	200	304	432	586	774	966	1,192	1,440	1,712
16	....	....	....	52	100	170	262	378	520	686	878	1,094	1,332	1,596
18	....	....	....	44	84	144	226	332	462	616	796	1,000	1,228	1,482
20	....	....	....	....	72	124	196	292	410	552	720	912	1,130	1,372

For tubes, or hollow columns, subtract the weight that may be borne by a column of the diameter of the internal diameter of the tube. The thickness of metal should not be less than one twelfth their diameter.

Fairbairn states that "it is better for the tension of a truss-rod to be low than high, and that the relative resistance to extension of cast iron, as compared with that of wrought iron, is as 1 to 2.25"; hence, where no initial tension is applied to a truss-rod, the cast iron must be ruptured before the wrought iron is sensibly extended.

Various experiments upon trussed beams show that their rigidity exceeds from six to eight times that of simple beams; that there is great gain of strength when the truss resists rupture, the upper flange being broken by compression; and that there is a great increase of strength when the upper flange is made larger than the lower one.

In order to preserve the same stiffness in bars, beams, etc., the depth must be increased in the same proportion as the length, the breadth remaining constant.

Barlow determined by experiments that the deflection of a beam from a transverse strain varied as the breadth directly, and as the cubes of both the depth and length; and that with like beams, and within the limits of the elasticity, it was directly as the weight.

But it is impracticable to give any positive laws of deflection of dissimilar bars, beams, etc., on account of the varied character of materials, the varied proportions of depth to length, the irregular resistance of beams with scarfs, trusses, etc., and the unequal deflection at initial and ultimate strains; hence reference must be had to the results of previous experiments upon bars, beams, etc., of a like character to those for which the deflection is required.

Many of these results are given in the following table, to which is added the value or constant obtained by the formula $\frac{l^3 W}{16 b h^3 D} = T$.

RESULTS OF EXPERIMENTS UPON THE DEFLECTION OF BARS, BEAMS, ETC., OF VARIOUS SECTIONS, ETC., BY UNITED STATES ORDNANCE CORPS, BARLOW, FAIRBAIRN, HODGKINSON, STEPHENSON, ETC.

Bar, Beams, etc., supported at Both Ends; Stress or Weight applied in the Middle.

Material and Section.	Length of Bearing.		Breadth.	Depth.	Depth of Opening.	Weight.	Deflection.	Value for Deflection Given. $\frac{l^3 W}{16 b h^3 D} = T$.
Woods.	Ft.	Ins.	Inch.	Inch.	Inch.	Lbs.	Inch.	Lbs.
Fir, rectangle	3	....	1.5	2.	......	120	.09	187
“ square	6	....	1 5	2.	......	180	1.	202
Ash, cylinder	3	10	2.	2.	......	715	2.7*	....
“ “ hollow	3	10	2.	2.	.5	657	2.5*	....
“ square	7	....	2.	2.	......	225	8.266†	238
Yellow pine, square	5	....	.75	.75	......	16	1.5	250
Oak, square	3	....	1.	1.	......	158	2.95	91
Pine, rectangular	40	....	7.5	9.25	......	1700	5.25	218
Metals.								
Cast iron, English	2	10	1.	1.	.....	300	.16†	2660
“ dry sand, square	1	8	2.	2.	......	10800	.11	1756
“ green sand, “	1	8	2.	2.	......	5000	.045†	1988
Flange, 5×.3	6	6	.36	1.55	......	112	.273	5302
	6	6	.36	1.55	......	336	1.03	4203
“ 4.5× .875 “ 9 ×1.25	22	....	1.12	36.	......	22400	.094	3035
Open beam, area 2	4	6	1.	2.5	.5	712	.132	1969
Wrought iron, square	2	9	2.	2	......	2240	.068	2678
“ “ rectangle	2	9	1.5	3.	......	2240	.074	971
Flange, 4.5×.5 Rib, 3.25 diameter	10	3	.5	10.	......	3136	.375‡	1126
Flanges, two of 2.25×.28 “ “ 2.25×.3	7	....	.25	7.	......	16480	.25	16480
Tubes, square, thickness, .03 in.	3	9	1.9	3.	......	448	.1	289
“ “ “ .525 in.	30	....	15.5	24.	......	5685	.12	373
“ circular, “ .037 in.	17	....	12.	12.	11.925	2755	.65*	....
Corrugated plates	31	6	3.1	8.	......	4480	.62	8893
Tubes, elliptical, thickness, .0416 in.	17	....	9.25	14.62	13.535	2262	.62*	....
“ “ “ .143 in.	17	....	9.75	15.	14.714	16800	1.39*	....
Steel, cast, soft	3	2	.23	.52	......	22	.331	4107
Brass, cast	1	....	.7	.45	......	60	.04†	1488

* Breaking weight. † Elasticity perfect. ‡ Permanent set.

63. The Torsional Strength, or resistance to twisting, of any square bar or beam is as the cube of its side; and of a cylinder, as the cube of its diameter.

Hollow cylinders or shafts have greater torsional strength than solid ones containing the same volume of material.

The torsional strength of bars of like diameters is inversely as their lengths.

It is impossible to give reliable rules for finding the torsional strength of materials varying in size, on account of the variations in the quality of castings as they increase in size; but the following tables exhibit the results of experiments by Major Wade for the United States Ordnance Corps:—

VARIOUS QUALITIES OF DIFFERENT METALS.

Metals.		Specific Gravity.	Tensile Strength.	Transverse Strength.	Torsional Strength for Diam. 1 in., and Length of 1 foot.		Crushing Strength.	Hardness.
					At ½ Degree.	Ultimate.		
			Per sq. in.	Per sq. in.	Lbs.	Lbs.	Per sq. in.	
Bronze.	Least	7.978	17,698	....	620	982	....	4 57
	Greatest	8.953	56,786	....	833	1,147	....	5.94
Cast Iron.	Least	6 900	9,000	416	1,006	2,732	84,529	4.57
	Greatest	7.400	45,970	958	2,500	5,012	174,120	33.51
	Mean	7.225	31,829	680	1,990	3,785	144,916	22.34
Cast Steel.	Least	7.729	....	....	....	....	198,944	....
	Greatest	8.953	128,000	1,916	....	13,690	391,985	....
Wrought Iron.	Least	7.704	38,027	542	970	2,175	40,000	10.45
	Greatest	7.858	74,592	....	1,320	2,608	127,720	12.14

RELATIVE VALUE OF DIFFERENT FIGURES TO RESIST TORSION, HAVING EQUAL SECTIONAL AREAS.

Solid Cylinder.	Solid Square.	Hollow Cylinders, the Interior and Exterior Diameters of which are in the Proportion of				
		4 to 10	5 to 10	6 to 10	7 to 10	8 to 10
1	.875	1.2656	1.4433	1.7	2.0864	2.7377

64. DETRUSIVE STRENGTH. — The *detrusive strength*, or resistance to punching, of any body is directly as its strength, or thickness, or area.

RESULTS OF EXPERIMENTS UPON THE DETRUSIVE STRENGTH OF METALS WITH A PUNCH.

Metals.	Diameter of Punch.	Thickness of Metal.	Power Exerted.	Power required for a Surface of Metal of 1 Square Inch.	
	Inch.	Inch.	Pounds.	Pounds.	
Brass	1.	.045	5,448	37,000	Note. — The free use of oil reduces the power required very materially.
Cast iron	..	...	......	30,000	
Copper	.5	.08	3,983	30,000	
	.5	.17	7,823		
	1.	.3	21,250	22 300	
Steel	.5	.25	34,270	90,000	
Wrought iron	.5	.08	6,025	45,000	
	.5	.17	11,950		
	.5	.24	17,000		
	1.	.615	82,870	43,900	
	2.	1.06	297,400	44,300	

SHAFTS AND GUDGEONS.

65. *Shafts* are divided into shafts and spindles, according to magnitude.

66. A *gudgeon* is the metal journal or arbor upon which a wooden or other shaft revolves.

67. Shafts are subjected to *torsional* and *lateral* stress combined, or lateral stress alone.

Shafts of equal length have *lateral stiffness* as their breadth and the cube of their depth, and have *lateral strength* as their breadth and the square of their depth; hence their stiffness increases with the depth in greater proportion than their strength.

Shafts of different lengths have *lateral stiffness* directly as their breadth and the cube of their depth, and inversely as the cube of their length; and have *lateral strength* directly as their breadth and the square of their depth, and inversely as their length: hence the stiffness decreases with their increased length in greater proportion than their strength.

Hollow shafts of equal lengths and quantities of material have *lateral stiffness* as the square of their diameter, and have lateral strength as their diameters; hence one having twice the diameter of another will have four times the stiffness, and but double the strength.

The stress upon a shaft from a weight upon it is proportional to the product of the distances from the weight to each end of the shaft. Thus, if a weight on a shaft 10 ft. in length is 3 ft. from one end, the stress is equal to $3 \times 7 = 21$; but if the weight were in the middle of said shaft, the stress would be $5 \times 5 = 25$.

Of course the end nearest the weight has to support the greater stress, and in the inverse proportion of the distance of the weight from the end.

68. *To compute the diameter of a shaft of cast iron to resist lateral stress only, when the stress is in the middle*, multiply the weight by the length of the shaft in feet, divide the product by 500, and the cube root of the quotient will be the diameter in inches.

69. *To compute the diameter of a solid shaft of cast iron to resist its own weight only*, multiply the cube of its length by .007, and the square root of the product will be the diameter in inches.

70. *To compute the diameters of shafts of wrought iron, oak, and pine*, multiply the diameter obtained for such a cast-iron shaft by .935 for wrought iron, by 1.83 for oak, and by 1.716 for pine.

71. GUDGEONS. *To compute the diameter of a single gudgeon of cast iron or wrought iron to support a given weight or stress*, divide the square root of the weight in pounds by 25 for cast iron, and by 26 for wrought iron, and the quotient will be the diameters respectively.

72. *To compute the diameter of two gudgeons of cast iron for a water wheel, to support a given weight or stress*, multiply the square root of the weight of half the wheel by .048, and the product will be the diameter in inches.

73. SPRINGS. The flexure of a spring is proportional to its load and to the cube of its length.

GRAVITATION, OR UNIVERSAL ATTRACTION.

74. *GRAVITATION* is a force which causes the particles of all bodies mutually to tend constantly toward each other.

The sum of the attraction between any two bodies is the resultant of the attraction of each molecule of the one upon every molecule of the other.

Newton's law may be expressed thus: *The sum of the attractions between two material particles is directly proportional to the product of their masses, and inversely proportional to the square of their distance asunder.*

Formula: $\frac{M M'}{d^2}$ = sum of attractions; M and M′ representing the masses respectively; d representing distance of bodies apart.

To illustrate: Two spheres, owing to their symmetry, attract each other as though their masses were concentrated in their centres. Suppose one of the spheres has its mass doubled, tripled, etc., the attraction between them would be doubled, tripled, etc. If, however, the mass of one sphere were doubled and that of the other tripled, the distance between their centres remaining the same, the attraction would be increased six times, — 3 times 2. But if their masses were not changed, and the distance between their centres were *increased* two, three, or four times, etc., the attraction would be *diminished* four, nine, or sixteen times, etc. (2 × 2, 3 × 3, or 4 × 4 times); or, in other words, the attraction decreases as the square of the distance increases.

75. The tendency of any body to fall to, or approach, the earth, is called TERRESTRIAL GRAVITATION, from the Latin *terra*, meaning land, or earth; and it is this particular case of universal attraction that we have to deal with in mechanics.

The line which a body falling in a vacuum describes, at any point of the earth's surface, is a *vertical line*, and is represented by the *plumb-line.*

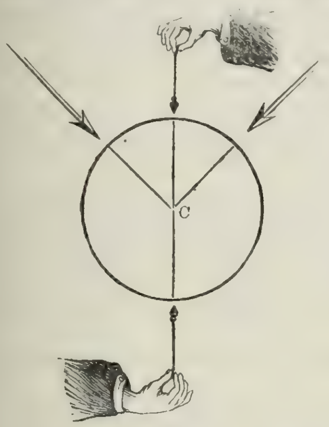


FIG. 1.

Since the earth is a globe, the *plumb-line*, at exactly opposite points of the earth, would, if connected, form one straight line and pass through the earth's centre. All bodies upon the earth's surface are attracted towards its centre, because, in a sphere, the particles on one side attract a body equally with those on another; consequently a falling body seeks the central point.

This truth is simply illustrated by Fig. 1, in which the plumb-line, from whatever point suspended, takes the direction of the centre, C, of the circle.

76. In every body there is some point toward which all the particles of the body tend, and through which the earth exerts its force; this is called the CENTRE OF GRAVITY, and is the point about which the whole body, if there supported, balances itself.

The *centre of gravity* may be found in different bodies in various ways, depending upon the shape of the body. See following illustrations : —

Figs. 2 and 3 represent irregular bodies suspended, the dotted lines showing the direction taken by the plumb-line from the different points of suspension. The point where these dotted lines intersect is the centre of gravity of each respectively.

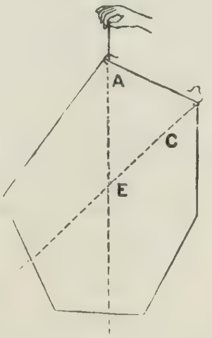


FIG. 2.

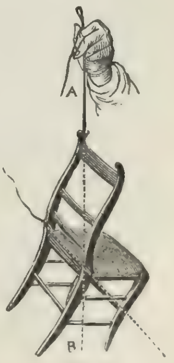


FIG. 3.

77. *EQUILIBRIUM* is a state of rest produced by the mutual counteraction of two or more forces. There are three kinds of equilibrium : —

Stable equilibrium, or that resulting from the suspension of a body at a point directly above the centre of gravity; *Unstable* equilibrium, or that resulting when a body is balanced on a point directly beneath the centre of gravity; *Neutral* equilibrium, or that produced when a body is suspended precisely at the centre of gravity, so that a change of position of the body neither raises nor lowers this centre. The balance is an example of stable equilibrium.

78. Remembering that the force of gravity acts through the centre of gravity of all bodies which are separated or have only external contact, let us consider for a moment the case of a body placed between the centre and circumference of another body, as a man going from the surface to the centre of the earth.

The moment he gets beneath the surface, he leaves particles of matter on the side of him opposite to the centre; and, as every particle of matter has attractive force in proportion to its quantity, the nearer he approaches the centre the greater will be the force attracting him away from it, and the less toward it. But just at the centre (provided he could reach it) the forces would be exactly equal on all sides: hence his weight would gradually decrease in his course, and at the centre would be nothing; for the *weight* of a body is only the *measure* of its *gravity*, or attraction toward the earth's centre.

The *measure of the decrease* in the weight of a body in moving from the circumference to the centre of the earth *would be directly as the distance from the surface increases;* hence, one mile below the surface (considering the earth's semidiameter to be 4,000 miles), the body would weigh $\frac{1}{4000}$ less than at the surface; at the distance of two miles, $\frac{2}{4000}$ less; at the distance of 1,000, $\frac{1000}{4000}$ or $\frac{1}{4}$ less; etc.

79. But the *measure of decrease* in the weight of a body moving from the surface of the earth and away from the centre *would be as the square of the distance from the centre increases*, in accordance with the law of universal attraction.

The weight of a body is not the same at all parts of the earth's surface for two reasons: 1. Because the equatorial diameter is 26½ miles greater than the polar diameter; hence a body at the equator would be further from the centre of the earth than it would be at the poles. 2. Because the centrifugal force which is due to the rotation of the earth on its axis is greatest at the equator, and there counteracts the force of gravity more than at any other part of the earth's surface.

These combined causes make the attraction of gravitation at the equator less by about $\frac{1}{192}$ of its value at the poles.

For instance, a mass of iron that weighs 1,000 pounds at the poles will weigh only 994.8 pounds at the equator.

80. While all bodies near the earth's surface tend towards its centre by force of gravity, yet some *apparently* are not thus attracted; but it is *only apparently*, for as the gravity is in proportion to the mass of the bodies, the body having the greatest quantity of matter in the same bulk will be attracted *most*, and will displace that which is attracted *less*, when there is not room for both, — as is the case with smoke, which generally rises because its relative density, or *specific gravity*, is less than air.

81. The weight of any body is simply *the measure of its gravity.*

WEIGHT OF SQUARE ROLLED IRON ONE FOOT IN LENGTH.

Sides.	Weight.	Sides.	Weight.	Sides.	Weight.	Sides.	Weight.	Sides.	Weight.
Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.
$\frac{1}{16}$	.0132	2½	21.120	5	84.480	7½	190.136	10	337.920
½	.845	3	30.416	5½	102.240	8	216.336	10½	372.672
1	3.380	3½	41.408	6	121.664	8½	244 220	11	408.960
1½	7.604	4	54.084	6½	142.816	9	273.792	11½	447.024
2	13.520	4½	68.448	7	165 632	9½	305.056	12	486 656

WEIGHT OF ROUND ROLLED IRON ONE FOOT IN LENGTH

Diam.	Weight.	Diam	Weight.	Diam.	Weight.	Diam.	Weight.	Diam	Weight.
Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.	Inches.	Lbs.
$\frac{1}{16}$	.0104	2½	16.688	5	66.752	7½	149.328	10	267.008
½	.663	3	23.888	5½	80.304	8	169.856	10½	292.688
1	2.654	3½	32.512	6	95.552	8½	191.808	11	321.216
1½	5.972	4	42.464	6½	112.160	9	215.040	11½	351.104
2	10.616	4½	53.760	7	130.048	9½	239.600	12	382.208

To obtain the weight of a piece of square or round rolled iron having other dimensions than those given in the above tables respectively. RULE. — When the side or diameter of the given piece is just double any one given in the tables, multiply the weight of the one found in the table by four; otherwise multiply the weight found in the proper table opposite $\frac{1}{16}$ by the square of the numerator of a fraction which represents the number of sixteenths in a side, or in the diameter, of the piece whose weight is wanted. The result will be the weight of one foot in length of the size desired. Thus: —

What would be the weight of a square rolled bar 1¾ inches on a side?
“ “ “ “ “ “ “ round rolled “ 1¾ “ in diameter?

$1\frac{3}{4} = \frac{7}{4} = \frac{28}{16}$; 28 × 28 × .013 = 10.352 lbs. weight square rolled bar.
$1\frac{3}{4} = \frac{7}{4} = \frac{28}{16}$; 28 × 28 × .0104 = 8.128 lbs. weight round rolled bar.

WEIGHT OF FLAT ROLLED IRON ONE FOOT IN LENGTH.

Width.	Thickness.	Weight.	Width.	Thickness.	Weight.	Width.	Thickness.	Weight.	Width.	Thickness.	Weight.
Inches.		Lbs.	Inches.		Lbs.	Inches.		Lbs.	Inches.		Lbs.
½	by ⅛	.211	1½	by ⅛	.633	2½	by ⅛	1.056	4	by ⅛	1.690
⅝	“ “	.264	1⅝	“ “	.686	2⅝	“ “	1 109	4¼	“ “	1.795
¾	“ “	.316	1¾	“ “	.739	2¾	“ “	1.162	4½	“ “	1.901
⅞	“ “	.369	1⅞	“ “	.792	2⅞	“ “	1.215	4¾	“ “	2.007
1	“ “	.422	2	“ “	.845	3	“ “	1.267	5	“ “	2.112
1⅛	“ “	.475	2⅛	“ “	.898	3¼	“ “	1.373	5¼	“ “	2.218
1¼	“ “	.528	2¼	“ “	.950	3½	“ “	1 479	5½	“ “	2 323
1⅜	“ “	.580	2⅜	“ “	1.003	3¾	“ “	1.584	5¾	“ “	2.429

To obtain the weight of a piece of flat rolled iron of a width corresponding with any one given in the table, but of a different thickness. RULE. — Multiply the weight found in the table opposite the given width by the numerator of the fraction representing the number of eighths in the number denoting the required depth. Thus: Width ½ inch, depth ⅜ inch; .211 × 3 = .633 lbs., required weight; or, if width be 3 inches and depth 1¼ inches, $1\frac{1}{4} = \frac{10}{8}$; 1.267 × 10 = 12.67 lbs., required weight.

82. *THE SPECIFIC GRAVITY*, or specific weight, of a substance is its *relative density*, or its gravity as compared with that of some other substance of the same bulk.

This comparative weight would be of little value unless there were some standard substances selected, with which all other substances might be compared: but, by common consent, distilled water at a temperature of 39.2° Fahr., or 4° centigrade, has been taken as a standard for the comparison of the weights of *solid* and *liquid* bodies; and *air* is the required standard for the comparison of *aeriform* bodies.

To find the specific gravity of a solid, using distilled water as the standard, we must of course compare the weight of the given solid with the weight of an equal bulk or volume of water; but the difficulty is in finding the exact volume of the solid when of irregular shape.

The method is very simple, and consists in ascertaining the weight of the solid as ordinarily weighed, and its weight when suspended by a thread and immersed in water, and dividing its ordinary weight, or weight in air, by its loss of weight in water. The body's loss of weight in water will be the exact weight of the same bulk of water; hence, by dividing its weight in air by its loss of weight in water, we are simply comparing the weight of the solid with the weight of an equal bulk of water.

Instead of proceeding as above, the weight of a volume of water, equal in bulk to that of the body whose specific gravity is sought, may be found by filling a small vessel exactly full of water, and carefully catching and weighing the water that overflows when the body is lightly lowered into it. The weight of the body in air divided by this result will give its specific gravity.

This method is based on the principle of the impenetrability of matter; viz., that two bodies cannot occupy the same space at the same time.

A solid, in order to displace the water, must exert a pressure downward sufficient to press its own bulk of water upward, and loses in weight thereby just the gravity or weight of that bulk of water, and no more, since the particles of water move freely and fill every vacant space of the solid.

Archimedes is said to have discovered the application of this principle in obtaining the relative densities of substances.

Hiero, king of Syracuse, wished to know if a crown which had been made for him were, as alleged, of pure gold: but he did not wish to injure its costly workmanship in ascertaining the fact; accordingly he requested Archimedes to determine whether the jeweller had dealt honestly with him.

For some time the problem remained unsolved; but, while taking a bath one day, he noticed that the water rose on the sides in proportion to the bulk of his body beneath the surface of the water. He at once concluded that any body of like volume, even if of less weight, would produce an equal result; and, feeling assured that he had discovered the means of determining the quality of Hiero's crown, he is said, in his excitement and elation, to have rushed naked into the street, shouting, "*Ευϱηκα! Ευϱηκα!*" ("I have found it! I have found it!")

To prove the correctness of his theory and determine his problem, he procured two pieces of metal, each equal to the crown in weight, one being pure gold, the other pure silver; then, putting the pieces of metal and the crown successively into a vessel exactly full of water, and carefully collecting and weighing the overflow of displaced water in each case, he found that the crown displaced more water than the gold piece and less than the silver piece; therefore its bulk was greater than the former and less than the latter. The crown, consequently, was neither pure gold nor pure silver, but was probably a mixture of both, or of gold and some other substance of nearly the same density as silver.

In obtaining the specific gravity of a solid or liquid body, it must be borne in mind that, no matter what process is taken, the object is to find the weight of a body of water equal in volume to the volume of the solid. The weight of the body, divided by the weight of the water, gives the specific gravity.

83. *To find the specific gravity of a solid that floats on the water*, attach to it some body heavy enough to sink it. Weigh the two, thus attached, in air and in water, and subtract the weight in water from the weight in air; the remainder will equal the weight of a bulk of water equal to both bodies. Then find the weight of the heavier body in air and in water; the difference will be the weight of the same bulk of water. Subtract the last result from the first, and the remainder will be the weight of a volume of water equal to the solid that floats. Divide its weight in air by this remainder, and the result will be its specific gravity, and it will be less than that of water.

84. The *specific gravity* of a *liquid* may be found by weighing a solid body in water, and then in the liquid whose specific gravity is to be determined: the loss in each case will be the respective weights of equal volumes of water and liquid. The weight of the liquid, divided by the weight of the water, gives the specific gravity of the liquid.

85. *To find the specific gravity of a gas*, divide the weight of any certain volume of the gas by the weight of an equal volume of air.

86. The weight of a cubic foot of water (which is $62\frac{1}{2}$ pounds, or 1,000 ounces) multiplied by the specific gravity of a solid or liquid, will give the weight of a cubic foot of that substance.

Thus: specific gravity of iron (average) is 7.11, which, multiplied by 1,000, = 7,110 ounces, the weight of a cubic foot of iron.

The volume of any given weight of a substance in cubic feet can be ascertained by dividing its weight in ounces by the weight of a cubic foot of the same, found as above, or by its specific gravity with its decimal point removed and considered as thousands. Thus: specific gravity of iron is 7.11 or 7.110; weight of a ton gross, 2,240 pounds × 16 = 35,840 ounces; 35,840 ÷ 7,110 = 5.04 cubic feet.

If the particles of every kind of matter were free to move among themselves, they would always be arranged in layers in the order of their specific gravity; as, for instance, let mercury, oil, and water, which have no affinity, be put together into a vessel, the mercury will at once form a layer at the bottom, the water a layer upon the mercury, and the oil will be on the surface; and this is in accord with their relative densities, or specific weights. The *actual density* of a solid, however, does not always determine whether it will sink or swim in water; but the space it occupies in proportion to its weight determines it, and this depends upon its shape. When, therefore, iron, which in compact form will instantly sink in water, is formed into a vessel of a shape and size sufficient to render its weight less than the weight of the volume of water it must displace in order to sink, it will float.

When a solid floats, it always displaces its own weight of the liquid. Upon this principle, iron ships are made to carry thousands of tons.

A knowledge of this principle is of great service in the common businesses of life as well as in the arts and sciences.

87. *To compute the proportions of two ingredients in a compound, or to discover adulteration in metals*, take the differences of each specific gravity of the ingredients and the specific gravity of the compound; multiply the gravity of each by the difference of the other; then, as the sum of the products is to the respective products, so is the specific gravity of the body to the proportions of the ingredients.

Example. — A compound of gold (specific gr. = 19) and silver (specific gr. = 10.5) has a specific gravity of 14. What is the proportion of each metal? Solution: —

$$19 - 14 = 5 \times 10.5 = 52.5$$
$$14 - 10.5 = 3.5 \times 19 = 66.5$$
$$\left.\begin{array}{l} 66.5 + 52.5 : 66.5 :: 14 : 7.824 \text{ gold,} \\ 66.5 + 52.5 : 52.5 :: 14 : 6.176 \text{ silver,} \end{array}\right\} \text{relative proportions.}$$

Supposing, in the above case, the weight of the compound were 20 pounds; to find the actual weight of gold and silver, make the statements:—

As the sum of the proportions (7.824 + 6.176 = 14) is to each proportion, so is the weight of the compound to the weights of gold and silver; or,

$$14 : 7.824 :: 20 : 11\tfrac{31}{175} \text{ pounds gold.}$$

$$14 : 6.176 :: 20 : 8\tfrac{144}{175} \text{ pounds silver.}$$

The above rule is, as will be readily seen, applicable to many cases of fraudulent adulterations.

88. *Specific Gravity of Gases compared with pure Air at 32° Fahr.*—Atmospheric air weighs 527.04 troy grains per cubic foot. Its assumed gravity is 1.000, but, compared with water, it is .00139.

Atmospheric Air	1.000	Sulphureted Hydrogen	1.191	Vapor of Sulphuric Acid	2.7
Carbonic Acid	1.529	Oxygen	1.1057	" " Alcohol	1.613
" Oxide	.967	Ammoniacal Gas	.589	Nitrous Acid	2.638
Hydro-chloric Acid	1.254	Hydrogen	.0693	" Oxide	1.527
Sulphurous Acid	2.21	Vapor of Bromine	5.1	Nitrogen	.971
Chlorine	3.44	" Iodine	8.675	Marsh Gas or Carburetted Hydrogen	.559
Cyanogen	1.86	" Spirits Turpentine	4.763		
		" Nitric Acid	3.75		

The weight in pounds per cubic foot may be obtained by removing the decimal point of the specific gravity, and dividing by 16.

89. The following table exhibits the weight per cubic inch or cubic foot and the specific gravities of many substances:—

COMPARISON OF METALS, ETC., AT 32° FAHR., WITH WATER AT 39.2° FAHR.

SUBSTANCE.	Specific Gravity.	Weight of Cubic Inch.	SUBSTANCE.	Specific Gravity.	Weight of Cubic Inch.	SUBSTANCE.	Specific Gravity.	Weight of Cubic
Gold, hammered	19.361	.7003	Mercury, 60°	13.580	.4912	Arsenic	5.763	.2084
" pure cast	19.258	.6965	" 212°	13.370	.4836	Aluminum	2.560	.0926
" 22 carat fine	17.486	.6325	Bismuth	9.823	.3553	Boron	2.000	.0723
" 20 carat fine	15.709	.5682	Brass, plate	8 380	.3031	Cobalt	8.600	.3111
Lead, rolled	11.388	.4119	" wire	8.214	.2972	Manganese	8.000	.2894
" cast	11.352	.4106	Nickel	8.800	.3183	Iron, wr'ght bars	7.788	.2817
Silver, ham'd pure	10.511	.3802	Copper, wire	8.878	.3212	" " wire	7.774	.2811
" cast pure	10.474	.3788	" cast	8.788	.3179	" cast, gun met.	7.308	.2640
Brass, Cop'r, 84 Tin, 16	8.832	.3194	" plates	8.698	.3146	" cast	7.207	.2607
" Cop'r, 67 Tin, 33	7.820	.2824	Bronze, gun metal	8.700	.3147	Zinc, rolled	7.191	.2600
Red Lead	8 940	.2340	Steel, wire	7.847	.2838	" cast	6.861	.2482
Platinum, rolled	22.069	.7982	" soft	7.833	.2833	Bromine	3 000	.1085
" ham'd	20.337	.7356	" tempered and hardened	7.818	.2828	Magnesium	1.750	.0633
" native	16.000	.5787	" plates	7.806	.2823	Calcium	1.580	.057
Mercury, —40°	15.632	.5661	Tin, Cornish, ham'd	7.390	.2673	Potassium	.865	.0313
" +32°	13.598	.4918	" " pure	7.291	.2637	Barium	.470	.0017
			Antimony	6.712	.2428	Sodium	.970	.0351

MINERALS, STONES, ETC.

SUBSTANCES.	Specific Gravity.	Weight of Cubic Foot.	SUBSTANCES.	Specific Gravity.	Weight of Cubic Foot.	SUBSTANCES.	Specific Gravity.	Weight of Cubic Foot.
Iodine	4.940	......	Diamond, Brazil	3.444	......	Plumbago	2.100	131.25
Topaz, Oriental	4.011	......	Glass, optical	3.450	215.625	Alum	1.714	107.125
Emery	4.000	250.	" flint	3.200	196.	Coal, anthracite	1.640	102.5
Carbon	3.500	218.75		2.933	183.312		1.436	89.75
Sapphire	3.994	......	" common	2.487	155.437	" other	1.238	77.375
Limestone, green	3.180	198.75		2.892	180.75		1.355	84.687
" white	3.156	197.25	Spar, calcareous	2.735	170.937	Rock crystal	2.735	170 937
Asbestos, starry	3.073	192.062	Spar, fluor	3.400	215.5	Marble, Parian	2.838	177.375
Slate	2.900	181.25	Chalk	2.784	174.	" Italian, white	2 708	169.25
	to			1.520	95.	" other	2.708	169.25
	2.672	167.	Alabaster, white	2.730	170.625		2.650	165.57
Talc, black	2.900	181.25	Porphyry, red	2.765	172.812	Turquoise	2.750	......
" mean	2.500	156.25				Lime, hydraulic	2.745	171.562
			Granite, Susquehanna	2.708	169.	" quick	.804	50.25
Sandstone, Staten Island	2.976	186.	" average	2.652	165.75	Coral, red	2.700	......
" mean	2.200	137 5	Quartz	2.660	166.25	" white	2.550	......
Mica	2.800	175.	Pearl, Oriental	2.650	.....	Flint	2.594	162.125
Ruby	4.283	......	Agate	2.590	......	Salt, common	2.130	133.125
Garnet	4.189	......	Porcelain, china	2.300	143.75	Saltpetre	2.090	130.625
" black	3.759	......	Gypsum, opaque	2.168	135.5	Borax	1.744	107.125
Hornblende	3.540	221.25	Opal	2.114	......	Amber	1.078	67.375
Diamond, Oriental,	3.521	......						
Butter	.942	58.875	Spermaceti	.943	58.937	Ivory	1.825	114.062
Camphor	.988	61.75	Ice, 32°	.920	57.5	Myrrh	1.360	85.
Egg	1.090	......	Starch	.950	59.375	Opium	1.336	83.5
			Tallow	.941	58.812	Indigo	1.009	63.062
Fat of beef and mutton	.923	57.687	Wax	.970	60.625	Soap, Castile	1.071	56.937
" of hogs	.936	58.5		to	to			
Caoutchouc	.903	56.437		.964	60.25			
Gutta-percha	.980	61 25	Horn	1.685	105.562			

LIQUIDS.

SUBSTANCES.	Specific Gravity.	Weight of Cubic Foot.	SUBSTANCES.	Specific Gravity.	Weight of Cubic Foot.	SUBSTANCES.	Specific Gravity.	Weight of Cubic Foot.
Acid, acetic	1.062	66.375	Proof spirits, 63°	.934	58.375	Water, 39.2° Fahr.	.999	62.3
" fluoric	1.500	93.75	" " 80°	.875	54.687	Ether	.923	57.63
" nitric	1.217	76.062	Oil, whale	.923	57.687	Brandy	.924	57.75
			" petroleum	.878	54.875	Wine, Burgundy	.992	62.
" muriatic or hydrochloric,	1.200	75.	Honey	1.450	90.625	" Madeira	1.038	64.375
			Blood (human)	1.051	65.875			
" phosphoric	1.558	97.375	Vinegar	1 080	67.5	" Port and Champagne,	.997	62.312
" " solid,	2.800	175.	Milk	1.032	64.5			
" sulphuric	1.849	115 532	Beer	1.034	64.625			
Alcohol, pure, 60°	.794	49.622	Water, distilled	1.000	62 5			

90. *Proof of Spirituous Liquors.* — A cubic inch of *proof spirits* weighs 234 grains. If a cubic inch of any immersed heavy body weighs 234 grains less in spirits than in air, it shows that the spirit is *proof.* If it loses less of its weight, the spirit is *above* proof; if it loses more, it is *below* proof, because pure alcohol has a less specific gravity than *proof spirits.*

FALLING BODIES

91. Terrestrial gravity produces the phenomenon of *falling bodies*, or the *motion* of bodies toward the earth's centre.

Motion is a change of position. Motion may be *accelerated*, or *retarded*, or *uniform*.

From Newton's law of universal gravitation, heretofore given, it follows that, but for the resistance of the air, the motion of a falling body would be uniformly accelerated; and the motion of a body forced upward, or away from the centre of the earth, would be uniformly retarded.

92. The VELOCITY, or rate of motion, of a falling body, is independent of its mass, or quantity of matter; for, as a body falls to the ground on account of the earth's attraction on *each* of its molecules, it follows that, everything else being equal, all bodies, great and small, light and heavy, ought to fall with equal rapidity; and a handful of sand without cohesion should, during its fall, retain the form in which it leaves the hand as perfectly as would a compact stone.

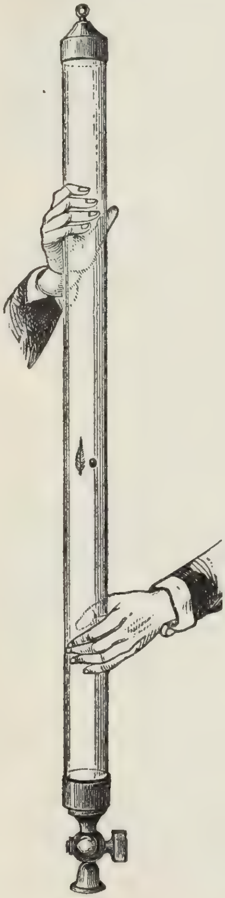


FIG. 4.

A stone falls more rapidly than a feather, not because of its greater density or weight, but because the air offers unequal resistance to their descent.

The following is a simple method of proving that the varying velocities of different falling bodies is due solely to the air:—

Take a glass tube of several yards in length, and introduce bodies of various weights and densities, as a feather and a coin; then fit a brass cock so that the air can be withdrawn by an air-pump. It will be found upon suddenly reversing the ends of the tube, after the air has been withdrawn, that all the bodies will fall in the same time; but on introducing a little air the lighter bodies are a little retarded in their fall, and the greater the amount of air introduced the greater the retardation of the lighter bodies in proportion to that of the denser bodies.

Here we see again the principles of specific gravity applied; only air instead of water is displaced, and, as air is much lighter than water, the displacing body loses less of its weight.

Until Galileo proved, in the presence of a large concourse of people, the fact that two balls (one exactly half the other's weight), dropped at the same moment from the summit of the Leaning Tower of Pisa, would reach the earth at the same instant, it had been held by philosophers, as well as the unlearned, that their velocity was in proportion to their weight.

It has been fully ascertained by experiment, and it is established as a fact, that a body falling freely, or in a vaccuum, passes over spaces in successive seconds of time, which increase in proportion to the odd numbers 1, 3, 5, 7, 9, etc.; that is, a body will fall 16.1 feet in the first second; 3 times 16.1 feet in the second second; 5 times 16.1 feet in the third second; 7 times 16.1 feet in the fourth second, etc.

From this we find that the entire space passed over in any time is as the square of that time; that is, in two seconds or minutes it will fall 4 times as far as in one second or minute, in three seconds or minutes, 9 times as far, etc.

When, therefore, we know the time of the fall of a body, we may calculate the height of its fall by multiplying the square of the time in seconds by the distance of fall in one second, or 16.1 feet. Thus: if the time were 4 seconds, the height would be (4×4), or 16, times $16.1 = 257.6$ feet.

It is evident that, as the *spaces* passed over in successive seconds regularly increase, the *velocity* must be uniformly accelerated as the time increases. Thus, at the end of two seconds the velocity acquired will be 2 times as great as at the end of one second; at the end of three seconds, 3 times as great, etc.

By experiment it is found that the velocity at the end of the first second will be about 32.2 feet. This is sufficiently exact for all illustrative or practical purposes.

As before stated herein, the force of gravity in different latitudes varies; and the authorities do not perfectly agree, but their variation is slight.

93. The following formulæ and table may give a better idea of the force of gravity as applied to falling bodies.

Let s represent the space.
" t " " time.
" v " " velocity the body has acquired at the end of that time.
" g " " velocity generated by gravity in 1 unit of the time, or the velocity at the end of the first second.

Gravity, being a constant force, will generate the same velocity in each successive interval; therefore, if g be the velocity in 1 unit, $2\,g$ would be the velocity in 2 *units;* and in t units, or the whole time, the velocity would be t times g or $g\,t$; hence $v = g\,t$.

The first formula is, therefore, $v = g\,t$.

That is, the velocity of a falling body, acted upon by gravity alone, at any moment of time may be found by multiplying the velocity generated in a unit of time, or at the end of the first second (which is g or 32.2 feet), by the time.

In a *uniform* motion, the velocity equals the space divided by the time, or $v = \frac{s}{t}$.

But by experiment it has been found, as above-mentioned, that the velocity generated in a unit or second of time is equal to twice the space passed over during that unit of time: hence v, as referred to the force of gravity and compared to the v of uniform motion, describes twice the space in the same time; therefore, for our purpose here, $v = \frac{2\,s}{t}$ and $2\,s = v\,t$.

If, in this last equation, we substitute the value of v in the formula $v = g\,t$, we will obtain $2\,s = g\,t \times t$, or $s = \frac{g\,t^2}{2}$, or $s = \frac{1}{2}\,g\,t^2$.

The second formula is, therefore, $s = \frac{1}{2}\,g\,t^2$.

That is, the space passed over in any given time equals the square of the time multiplied by one half the velocity at the end of the first second, or 16.1 feet, — the space passed through during the first second, as heretofore stated.

By using these formulæ, any one of the elements entering into them may be obtained when the others are given.

By transposing and combining them we find that —

$$v = \frac{2\,s}{t}, \text{ or } \sqrt{2\,g\,s}, \text{ or } g\,t.$$

$$s = \frac{v^2}{2\,g}, \text{ or } \tfrac{1}{2}\,t\,v, \text{ or } \tfrac{1}{2}\,g\,t^2.$$

$$t = \frac{v}{g}, \text{ or } \sqrt{\frac{2\,s}{g}}, \text{ or } \frac{2\,s}{v}$$

$$g = \frac{v}{t} \text{ or } \frac{2\,s}{t^2}, \text{ or } \frac{v^2}{2\,s}$$

After what has been said, it is believed the reader will be able to interpret the transformations of the formulæ here given.

Note. — See Appendix to Arithmetic for operation with formulæ.

The following table exhibits the numbers by which 16.1 feet (the space fallen through in the first second) must be multiplied to give the results indicated at the head of each column.

The table may be extended indefinitely by, in the second and third columns, continually adding two; in the last, by squaring the number opposite in the first column.

Number of Seconds falling.	Spaces fallen through in each Successive Second.	Velocity acquired at End of the Seconds opposite in First Column.	Total Height of Fall in Number of Seconds opposite in First Column.
1	1	2	1
2	3	4	4
3	5	6	9
4	7	8	16
5	9	10	25
6	11	12	36
7	13	14	49
8	15	16	64
9	17	18	81
10	19	20	100
	EXAMPLE. $16.1 \times 1 = 16.1$ $16.1 \times 3 = 48\ 3$ Etc.	EXAMPLE. $16.1 \times 2 = 32.2$ $16.1 \times 4 = 64.4$ Etc.	EXAMPLE. $16.1 \times 1 = 16.1$ $16.1 \times 4 = 64.4$ Etc.

94. We find, from a comparison of the velocities acquired by a falling body in successive seconds, that its velocity increased 32.2 feet, or g, each second; and, since a body ascending perpendicularly is acted upon by the same force, it will be retarded to a like extent, and finally brought to rest at a height from which it would necessarily have fallen to have acquired, in its entire fall, a velocity equal to that with which it commenced its upward course: hence the number of seconds it will continue to rise may be found by dividing its initial velocity, or that with which it starts, by 32.2, or g.

Having thus found the time of its ascent, the height may be found in the same manner as the space is found through which a body would fall in that time, or by the formula $s = \frac{1}{2} g t^2$.

95. The rules thus far given relative to falling bodies apply only to those moving freely; that is, without the resistance of the air, or the action of any other force than gravity. If a body be *thrown* downward, the velocity with which it is thrown must be added to that acquired by gravity.

For example: If an iron ball be thrown perpendicularly downward from a height with a force of thirty feet per second, at the end of ten seconds it would have passed over a space of 300 feet in addition to the space passed over by the force of gravity, which would be $\frac{1}{2} g t^2$ or $16.1 \times 100 = 1610$ feet, making the whole space passed over $1610 + 300 = 1910$ feet. *The formula for this would be,—*

$$S = \frac{1}{2} g t^2 + v t.$$

The resistance of the air has been found to neutralize about $\frac{1}{6}$ of the velocity which a body acquires when falling freely. Experiments in St. Paul's Cathedral, London, show that, with the air opposing, a body falls 272 feet in 4½ seconds, while one unopposed by the air would fall 326.025 feet.

96. The effect of gravity upon the chandeliers in a church in Florence, when put in

motion, led Galileo, as he observed the regularity of the times of their vibration whether they moved through a greater or less space, to investigate the cause of this regularity, and to suggest that *time* might be thus measured. He discovered that bodies thus suspended would have their motion as much accelerated while descending as retarded while ascending, and, when once set in motion, would move perpetually were they not opposed by the air and friction; but it was necessary to overcome these opposing forces by some invention, and it was accomplished in the year 1658, by Huyghens, a Dutch astronomer.

A common clock is only an arrangement for registering the number of oscillations which a pendulum makes, and for communicating to the pendulum at the same time, by means of a weight, a sufficient momentum to overcome friction and the resistance of the air. The time of vibration of a pendulum depends upon its length. The laws governing the vibrations of the pendulum are briefly as follows: —

1. The vibrations of a given pendulum are very nearly equal in time, whether it moves in longer or shorter arcs.

2. The vibrations of pendulums of varying length are performed in different times, and their lengths are in proportion to the square of their time of vibration.

3. The vibrations of the same pendulum are performed in different times in different degrees of latitude, increasing or diminishing in number as the force of gravity increases or diminishes. In accordance with this last rule, the pendulum of a clock, in order to vibrate uniformly while going from the equator to the pole, would need to be gradually lengthened.

PROJECTILES.

97. Gravity acts upon *projectiles* exactly as upon bodies falling vertically, and brings them to the earth from the same height in the same time. A ball discharged from a cannon on a tower in a horizontal direction will reach the ground on a horizontal plain at the same moment as a ball dropped at the instant of the cannon's discharge; but it will not describe the same curve — a parabola — as it would were its motion unresisted by the atmosphere.

98. Gravity also keeps all things upon the earth's surface from flying off into space, as is the tendency generated by the revolution of the earth upon its axis.

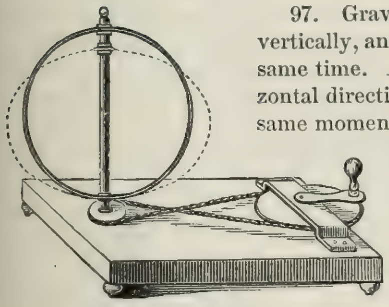


Fig. 5.

This motion, or tendency to fly from a centre of revolution, is called *CENTRIFUGAL FORCE*, and has been heretofore referred to, under *weight*, as producing the bulging at the equator, and thus changing the form of the earth from a sphere to an ellipsoid. This is illustrated (Fig. 5) by so arranging a flexible metal hoop upon an upright axis, that, when the hoop is made to revolve rapidly by a proper arrangement of wheels and a band, the centrifugal force will cause it to spread in the direction of its motion, and will draw down its loosened upper side, thus exhibiting an elliptical shape.

99. Gravity, in opposition to this force or motion, — for these terms are here synonymous, — is called *CENTRIPETAL FORCE*.

100. Motion results in *force*, and *force* produces *motion;* and as all nature is in motion, even where apparently at rest, it is mere matter for conjecture whether force originally produced, or resulted from, motion. The generally received doctrine, however, is, that an

original impulse must have been given to matter, and that the result is perpetual motion. It can, however, be easily shown that the only force necessary to continue a perpetual motion of one of the celestial spheres about another, as the moon about the earth or the earth about the sun, is the attraction of gravitation; and that the moon is simply falling continuously toward the earth, in accordance with the law of universal gravitation heretofore given, but does not reach it, because the earth is limited in extent, and globular in shape.

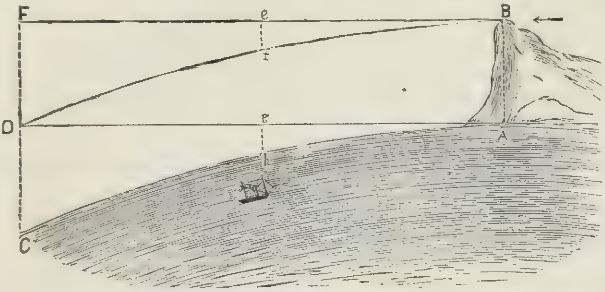


FIG. 6.

This is illustrated by Fig. 6, in which A B represents a high mountain, on the surface of the earth A C. A cannon-ball propelled from the summit of the mountain with a velocity of five miles per second, and meeting with no resistance from the air, would reach the point *f*, in the curved line B D, at the end of the first second. As it has been falling toward the earth during this second, the point *f* will be 16.1 feet below *e* on the horizontal line B F, in accordance with the law of falling bodies. But the earth curves away 16.1 feet from the horizontal line A D in a distance of five miles: hence the ball is no nearer at the end of the first second than when it started. At the end of the second second, the ball would reach the point D, five miles from *f*, and, by the law just mentioned, would be 64.4 feet below F; while the earth's surface will be 64.4 feet below D at C, and the ball will still be no nearer the earth. We thus see that the earth's surface curves away from any given point at the same rate in each successive five miles as a body increases its distance of fall in successive seconds; hence it would only be necessary for a body near the earth's surface to have a velocity of about five miles per second, if unopposed by the atmosphere, in order to revolve perpetually by the force of gravitation. The moon's motion about the earth is on this principle.

That the turning of the earth on its axis, and its revolution about the sun, are due to gravity, is quite well illustrated by the GYROSCOPE, as is also the gyration or change of position of the earth's axis relatively to the sun.

101. The CENTRIFUGAL FORCE of a revolving body increases according to the square of its velocity; hence, if the earth revolved twice as fast as it now does about the sun, its centrifugal force would be four times as great. This accounts also for the great velocity of a stone sent from a swiftly revolving sling; for the bursting of grindstones; and the flying of mud from the wheels of a swiftly moving carriage, when the centrifugal force exceeds the mud's adhesion. When the centrifugal force, in the revolution of a body on its axis, overcomes the force of cohesion, adhesion, or the centripetal force, whatever it may be, of the particles at its circumference, they fly off in straight lines tangent to the circumference, as represented in Fig. 8, and would continue to move in a straight line if not interfered with by some outside force.

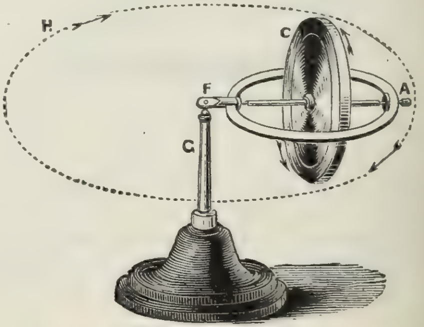


FIG. 7.—The Gyroscope.

102. The earth turning on its axis carries all things on its surface with great rapidity; yet a force acting on any object on its surface causes it to move in the same direction, and with the same velocity, as if the earth were at rest. A body acted upon by two uniform forces moves between them in a diagonal of a parallelogram whose sides are proportional to the forces. The action of two equal forces—the *centrifugal* and the *centripetal*—produce, or are generally believed to produce, *circular motion* in celestial bodies, as in bodies on the earth's surface.

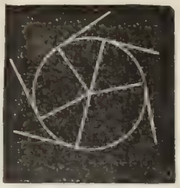


Fig. 8.

We believe, however, that circular motion once begun continues by the single force of gravitation, and that the centrifugal force is simply the motion, or tendency to motion, of the body, in a straight line, and is the continuous result of gravity.

103. The Momentum of a body is the force with which one body in motion would strike another, and equals its velocity multiplied by its mass or quantity of matter; hence, when the velocity of two moving bodies is the same, their momentum, or striking force, will be in proportion to their mass or weight, and, their mass or weight being the same, their momentum will be directly as their velocities.

A *light* body may be made to strike with a greater force than a *heavy* one by sufficiently increasing its *velocity;* evidence of which is frequently given in the sweeping away of whole villages by air in rapid motion. Motion is *then* translated into force, or energy, as some philosophers call it to distinguish this kind of force from that applied to produce motion.

104. The power which a body in motion has to impart motion to another body we designate by the term Action; and the resisting power of the body acted upon we term Reaction.

Action and Reaction are always equal and opposite. Thus, the forward motion of the bullet and the backward motion or "recoil" of the gun are equal; but we do not observe its effect frequently, because the motion impressed upon the gun is upon a large quantity of matter in proportion to the bullet.

105. *REFLECTED MOTION* is that resulting from the reaction of an elastic body when thrown against a hard, smooth surface; and the angles made with the perpendicular, erected at point of contact, by the lines of approach and departure from the surface are always equal. The line of approach forms with the perpendicular the Angle of Incidence; and the line of reflection forms with the perpendicular the Angle of Reflection.

In Fig. 9 the angle A B D is the angle of incidence, and the angle D B C the angle of reflection.

MECHANICAL POWERS.

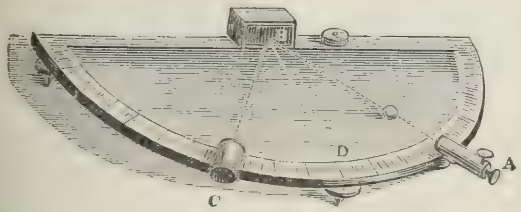


Fig. 9.

106. We are now ready to consider the application of motive-power or force to machinery; and, as a preliminary, we will briefly mention the so-called *mechanical powers*, or instruments used in the application of force.

Machines, in all their variations, are only the combinations, to a greater or less extent, of six elementary principles called MECHANICAL POWERS. These are known as the *lever*, the *wheel* and *axle*, the *pulley*, the *inclined plane*, the *wedge*, and the *screw*.

THE LEVER.

107. The *lever* is any bar, curved or straight, turning upon a pivot or prop. The *pivot* or *prop* is called the *fulcrum;* and those parts of the bar extending each side of the fulcrum are called the *arms.*

108. There are three kinds or classes of the lever, determined by the relative positions of the power, weight, and fulcrum.

The *fulcrum*, in the first class, is *between* the *weight* and the *power;* in the second class, the *fulcrum* is at one *end* of the lever, with the *weight* between it and the *power;* and in the third class, the *fulcrum* is at one end, with the *power* between it and the *weight.*

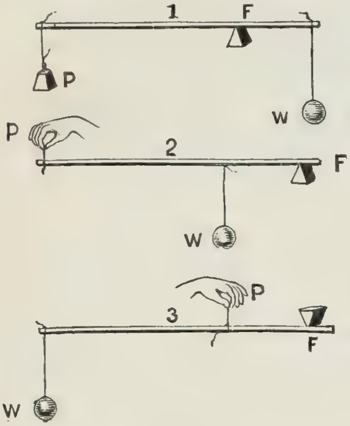


Fig. 10.

These several levers are represented in their order, 1st, 2d, and 3d class, numbered 1, 2, 3, respectively, in Fig. 10.

109. *In each of these cases, the power is to the weight in the inverse ratio of their arms;* that is, force is gained and time lost in proportion as the distance between the power and the fulcrum exceeds the distance between the weight and the fulcrum. Thus, when, in a lever of the first class, the power and the weight are equal, *they must be at equal distances from the fulcrum* in order to exactly balance each other; but when the power is only half the weight, *it must be at double the distance from the fulcrum* in order to balance the weight; and if the power be only one third the weight, *it must be three times as far from the fulcrum* as the weight is.

If a 600-pound weight be placed on the short arm of the lever two feet from the fulcrum, a power of 100 pounds will need to be applied to the long arm, 12 feet from the fulcrum, in order to balance the weight, for 600 × 2 = 100 × 12.

110. Levers of the second and third classes are governed by the same law.

To find the distance of a given power from the fulcrum in order to balance a weight at a given distance from it, multiply the weight by its distance from the fulcrum and divide the product by the power.

To find the power necessary to be applied at a given distance from the fulcrum to balance a weight at a given distance, multiply the weight by its distance from the fulcrum, and divide the product by the distance at which the power is to be applied.

111. If several levers are combined so as to form a *compound lever*, the shorter arm of one acting upon the longer arm of another, then, to find what weight on the short arm a certain force applied to the long arm will raise, *multiply the power by the continued product of the long arms, and divide by the continued product of the short arms.*

Thus, if three levers were combined as shown in Fig. 11, the long arms of each being ten times the length of the short arms, then the power of one pound at P would exert a power of 1,000 pounds at W, or 1 (10 × 10 × 10) ÷ 1 × 1 × 1 = 1,000.

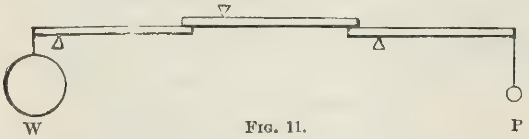


Fig. 11.

112. The common steelyard, the balance, and the crow-bar, when the power acts in a direction opposite to that in which the weight moves, are examples of the lever of the *first class*.

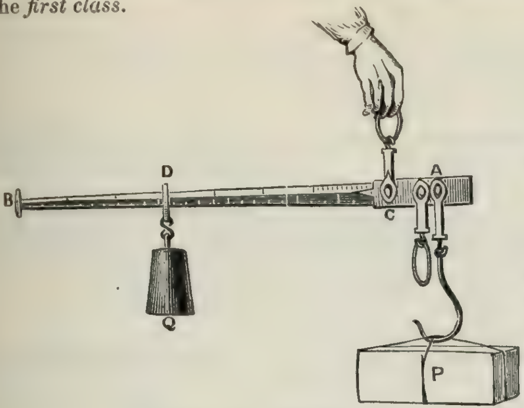


FIG. 12.—Steelyard.

FIG. 13.—Nut-Cracker.

113. Lemon-squeezers, nut-crackers, oars, and the wheelbarrow are examples of the *second class* of levers.

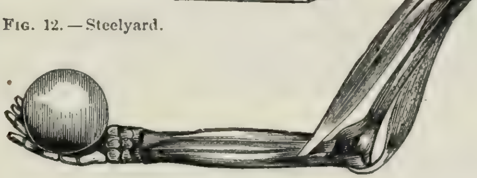


FIG. 14.—Arm.

114. The legs and claws of birds, and the limbs of animals generally, are examples of the *third class*.

WHEEL AND AXLE.

115. The *wheel* and *axle* consists of a cylinder, or axle, revolving on an axis, and having a wheel of greater diameter rigidly fixed to it. The *power* is applied in a line tangent to the circumference of the *wheel;* and the *resistance* is in a line tangent to the circumference of the *axle*, as, for instance, in the water-wheel. In the *capstan*, the power is applied to spokes fixed in the axle, which represent semidiameters of the wheel. The *windlass* is another example.

We may consider the *wheel* and *axle*, in all its modifications, as an application of the *lever*, the arms of which are the radii respectively of the wheel and the axle.

116. A combination of wheels and axles may be made, and the result found exactly as in the compound lever; that is, *to find the weight*, multiply the product of the radii, or semidiameters of the wheels, by the power, and divide by the product of the radii, or semidiameters, of the axles.

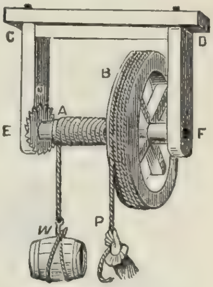


FIG. 15.—Wheel and Axle.

The wheel-work of a watch is on this principle. Wheels may be connected, and motion produced, by belts as well as teeth.

PULLEYS.

117. The *pulley* is a hard, circular disk, or small wheel, of wood or metal, in the circumference of which is a groove, arranged to turn freely on an axis in the centre. A *fixed* pulley simply revolves on its axis, without change of place; but a *movable* pulley rises and falls with the weight attached.

118. When several pulleys are combined, in general, the advantage gained is found by multiplying the number of movable pulleys by two, or by multiplying the power by the number of folds in the rope which sustains the weight. Thus: —

If there are six pulleys, to find the weight sustained the power must be multiplied by twelve, or 6 × 2. When, in a system of movable pulleys, each pulley has a separate rope attached at one end to a fixed support, the power balances a weight as many times greater than itself as is 2 raised to the power denoted by the number of movable pulleys.

Thus (Fig. 16): If the power be 1 pound, and the number of movable pulleys three, the weight balanced will equal $1 \times 2 \times 2 \times 2 = 8$ pounds.

Fixed and movable pulleys are arranged in many forms, but the principle in all is the same. A *tackle and fall*, or *block and tackle*, is only several pulleys in a sheath.

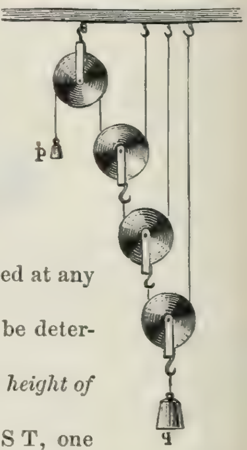


Fig. 16. — Pulley.

INCLINED PLANE.

119. The *inclined plane* is simply a hard, plane surface, inclined at any angle.

The advantages gained by the use of the inclined plane may be determined as follows: —

Equilibrium is obtained when the power is to the weight as the height of the plane to its length. Thus: —

If, in Fig. 17, the plane R S be twice as long as the height S T, one pound at P, acting over the pulley, would balance two pounds anywhere between R and S; and if the plane be three times its height, one pound at P would balance three pounds at any point of R S, and so on.

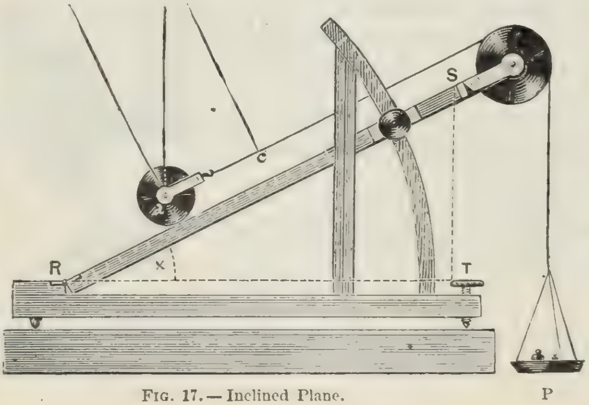


Fig. 17. — Inclined Plane.

THE WEDGE.

120. The *wedge* is a movable inclined plane; or it is usually two such planes, with their bases united.

The *power* of the wedge increases as the length of its back, as compared with that of its side, is diminished; therefore its power is in proportion to its sharpness. Knives, chisels, razors, and cutting-tools generally are wedges.

Practical rules for the wedge cannot be given, as the power must depend upon the rift in the wood to be cleft.

THE SCREW.

121. The *screw* is an inclined plane winding about a cylinder, and may be illustrated by a piece of paper in the shape of a right-angled triangle wrapped about a cylinder, and having its base at the base of the cylinder, while its hypothenuse makes a screw-line on the surface of the cylinder.

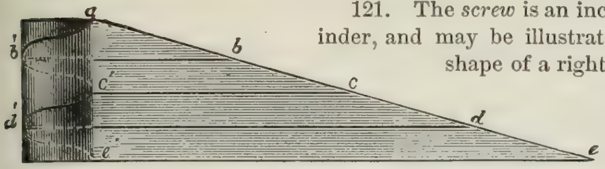


FIG. 18.—Inclined Plane wrapped around Cylinder.

122. An ordinary *screw* consists of an elevation on a solid cylinder; and when a corresponding groove is cut in a hollow cylinder of the same diameter, it produces a companion screw or *nut*.

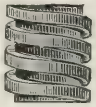


FIG. 19.
Screw.

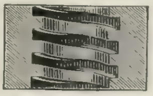


FIG. 20.
Internal Screw or Nut.

123. The vertical distance between any two threads of a screw, measured parallel to the axis, is called the *pitch*, as *a c'*, Fig. 18; and the angle *a c c'* or *a e e'* is called the inclination of the screw.

The screw being a modification of the inclined plane, the conditions of equilibrium are those which apply in the case of the plane.

124. The power is usually applied by a lever, as in a copying press; and the principle may be stated generally, *that the power of the screw is to the resistance in the same ratio as the pitch of the screw to the circumference of the circle through which the power acts.*

The screw thus acts with the combined power of lever and inclined plane.

Suppose the *pitch*, or distance between the threads, to be *one inch*, and the *handle of the screw* (that is, the lever) to be *two feet* in length, the circumference of the circle described by its extremity will be $2 \times 2 \times 3.1416 = 12.57$ feet, or 150.84 inches; hence the ratio between the power and weight will be as 1 to 150.84.

Consequently, if a man be capable of exerting a force of 80 pounds at the end of the lever, the force with which a screw will advance will be found by the proportion, 1 : 150.84 :: 80 : 12067.20 pounds.

If the threads were *one half inch*, the force exerted would be doubled; and the proportion would be $\frac{1}{2}$: 150.84 :: 80 : 24134.40 pounds.

This is theoretically correct, but in practice about $\frac{1}{4}$ must be allowed for friction.

125. *To compute the power of the screw without lever*, multiply the weight or resistance to be sustained by the pitch of the threads, and divide the product by the length of the plane which forms the screw thread, or $\frac{W \times p}{l} =$ power.

Thus: What is the power required to raise a weight of 8,000 pounds by a screw 12 inches in circumference and 1 inch pitch?

Find the length of plane by adding the square of 12 (the circumference) to the square of 1 (the pitch), and extracting the square root, $12^2 + 1^2 = 145$, and $\sqrt{145} = 12.04159$; then $\frac{8000 \times 1}{12.04159} = 664.36$ pounds.

The formula to compute the weight is, $\frac{P + l}{p} =$ weight.

FRICTION.

126. Friction, as applicable to the above-mentioned machines, is of two kinds,— *sliding*, as when one body slides over another; and *rolling*, which occurs when one body rolls over another, as an ordinary wheel.

Rolling is less than *sliding* friction, because, by rolling, the inequalities of one body are raised over those of the other.

127. Friction is independent of the extent of the surfaces in contact when the pressure is the same; that is, a hundred pounds' weight produces no more friction on a hundred square feet of surface than on one foot of surface.

128. That fraction of the pressure which is required to overcome friction is called the *coefficient of friction.*

To compute the coefficient of the friction of bodies, place them upon a horizontal plane, attach a cord to them and lead it in a direction parallel to the plane over a pulley, and suspend from it a scale in which weights are to be placed until the body moves.

The weight that moves a body is the *numerator*, and the weight of the body moved is the *denominator*, of a fraction which represents the coefficient required.

Thus: If, by a pressure of 480 pounds, the friction amount to 96 pounds, the coefficient of friction would be $\frac{96}{480} = .2$, the coefficient.

Hence, if the coefficient of friction of a wagon over a sandy road were .2 and the load 9,000 pounds, the power required to draw it would be $9,000 \times .2 = 1,800$ pounds.

FRICTION OF ROADS.

129. The *friction of roads* is about as follows: A wagon, with its load weighing 1,000 pounds, requires a traction or drawing power, —

On loose sand,	of 250	pounds,	or	.25	of	the load.
“ fresh earth,	“ 140	“	“	.125	“	“
“ common by-roads,	“ 106	“	“	.1	“	“
“ hard, dry meadow,	“ 40	“	“	.04	“	“
“ macadamized roads,	“ 33	“	“	.033	“	“
“ dry highroads,	“ 25	“	“	.025	“	“
“ railroads,	“ 6 to 3.5	“	“	$\begin{cases} .0035 \\ .0059 \end{cases}$	“	“
“ well-paved roads the friction is $\frac{1}{71}$st part					“	“
“ gravel-bed “ “ “ $\frac{1}{35}$th “					“	“

Influence of the Diameter of Wheels.—The results of experiments show that on solid roads it may be admitted as a law that the traction is inversely proportionate to the diameters of the wheels.

Influence of the Width of Wheels.—Experiments made upon wheels of different breadths, having the same diameter, give the following results: —

1. *On soft grounds*, the resistance to rolling increases as the width of the felloe.
2. *On hard ground and roads of like firmness*, the resistance is very nearly independent of the width of the felloe.

INFLUENCE OF VELOCITY.

VEHICLES.	ROADS.	LOADS.	Speed in Miles per Hour.	Traction.	Ratio of Traction to Load.
		Pounds.		Pounds.	
Carriage on a brass shaft	Wet gravel and soft..	2,300	3.13	364	1 to 6.3
			6 26	370	1 to 6.2
16-lb. carriage and piece	Hard gravel, even and dry,	8,270	2.82	203	1 to 40.8
			3.4	203	1 to 40.8
			8.45	267	1 to 31
Wagon on six springs	Good sand	7,250	2.77	318	1 to 22.8
			5.28	355	1 to 20.8
		7,400	8.05	406	1 to 18.3

The results show that on soft grounds traction has no sensible augmentation with an increase of velocity, but that on solid and uneven-surfaced roads it increases with an increase of velocity; and in a greater degree as the surface is uneven and the vehicle has less spring.

TABLE OF THE COEFFICIENTS OF FRICTION UNDER PRESSURES INCREASED GRADUALLY UP TO THE LIMIT OF ABRASION. [G. RENNIE.]

Pressure per Square Inch.	COEFFICIENT.				Pressure per Square Inch.	COEFFICIENT.			
	Wrought Iron upon Wrought Iron.	Wrought Iron upon Cast Iron.	Steel upon Cast Iron.	Brass upon Cast Iron.		Wrought Iron upon Wrought Iron.	Wrought Iron upon Cast Iron.	Steel upon Cast Iron.	Brass upon Cast Iron.
Pounds.					Pounds.				
32.5	.14	.174	.166	.157	485	.403	.366	.356	.221
186	.25	.275	.3	.225	523	.409	.366	.357	.223
224	.271	.292	.333	.219	600	...	.367	.359	.234
298	.297	.320	.344	.211	672	...	.376	.403	.233
336	.312	.333	.347	.215	710	...	.434	...	.234
390	.376	.363	.353	.205	820	...	...	...	.273

LOCOMOTIVE AND RAILWAY TRAINS.

130. Locomotive-moving friction, 15 lbs. per ton; train-moving friction, 6 lbs. per ton.

COEFFICIENTS OF AXLE-FRICTION. [M. MORIN.]

SUBSTANCES.	Condition of the Surfaces and Unguents.				
	Dry and a little Greasy.	Greasy and Wetted with Water.	Oil, Tallow, or Lard.		Very Soft and Purified Carriage Grease.
			In the Usual Way.	Continuously.	
Bell-metal upon bell-metal	...	...	.097	...	...
Cast iron upon bell-metal...........	...	...	...	.049	...
Cast iron upon bell-metal....................	.194	.161	.075	.054	.065
Cast iron upon cast iron......................	...	.079	.075	.054	...
Cast iron upon lignum-vitæ.................	.185	...	.1	.002	.109
Lignum-vitæ upon cast iron.................	...	...	.116	...	...
Lignum-vitæ upon lignum-vitæ..............	...	...	...	.07	...
Wrought iron upon bell-metal	.251	.189	.075	.054	.09
Wrought iron upon cast iron..................	...	...	.075	.054	...
Wrought iron upon lignum-vitæ.............	.188	...	.125	...	...

RELATIVE VALUE OF UNGUENTS TO REDUCE FRICTION.

Unguents.	Wood upon Wood.	Wood upon Metals.	Metals upon Metals.	Unguents.	Wood upon Wood.	Wood upon Metals	Metals upon Metals.
Dry soap	.4	.32	.27	Olive-oil	..	1.	1.
Lard	.82	.85	.7	Tallow	1.	.93	.8
Lard and plumbago	.	.67	.96	Water	.22	.24	.18

131. The disadvantages of friction in some directions are more than replaced by its benefits in other directions; for without it power could not be transmitted from wheel to wheel, by belts and bands, and in many other ways now employed; and we, as individuals, would be almost helpless in our movements, as we now are on ice.

MOTION IN MACHINES.

132. The varieties of motion which occur in machinery are comprised in the terms *rotary* and *rectilinear*.

Examples of *rotary* motion are seen in all kinds of wheel-work; and a common pump-rod, and the piston of a steam-engine, in motion are examples of *rectilinear* motion.

133. The *crank* is a double winch or handle, and is formed by bending an axle so as to form four right angles facing in opposite directions.

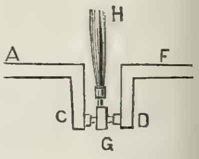


Fig. 21.—The Crank.

HYDROSTATICS.

134. *HYDROSTATICS* treats of the conditions of the equilibrium of *liquids* and the pressures they exert within their own mass, or upon the sides of vessels in which they are contained.

Although the molecules of liquid bodies are displaced by a slight force, there is a sufficient adherence between them to produce a greater or less friction.

As compared with fluids of gaseous form, *liquids have little compressibility.*

All liquids are subject to the same laws of equilibrium and pressure; but, as water is so common in nature, it is in water that we most frequently see these principles manifested.

It has been ascertained by experiment that, under a pressure of 15,000 pounds to the square inch, water is reduced one twenty-fourth part of its bulk; and it is found generally that, within certain limits, the decrease in bulk is proportional to the pressure.

135. When the pressure upon a liquid is removed, it regains its original volume; *hence liquids are considered perfectly elastic.*

Assuming liquids to be perfectly fluid, and uninfluenced by the action of gravity, Pascal enunciated the law that *pressure exerted anywhere upon a mass of liquid is transmitted undiminished in all directions, and acts with equal force on all equal surfaces, and in a direction at right angles to those surfaces.*

A satisfactory demonstration of this principle cannot be given, because the influence of the weight of the liquid and the friction of the piston cannot be eliminated or removed. Yet an approximate verification can be effected as follows:—

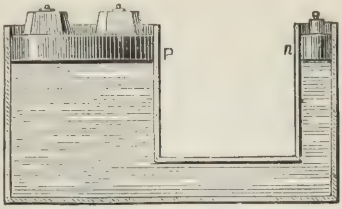


Fig. 22. — Pressure of Liquids.

Two cylinders of different diameters are connected by a tube, as in Fig. 22, and have pistons whose areas are as 30 to 1.

Let a weight of 3 pounds be placed upon the small piston, and this pressure of 3 pounds will be transmitted or conveyed to each portion of the water, and each part of the large piston equal to the surface of the small piston; hence the large piston will be pressed upward with a force thirty times that downward upon the small piston, or thirty times 3 = 90 pounds.

136. The *HYDROSTATIC PRESS* is simply an application of this principle to actual work, and constitutes the most powerful mechanical engine for compressing cotton, raising great weights, and testing the strength of certain materials, etc.

THE VERTICAL PRESSURE OF LIQUIDS.

137. If we suppose any liquid in a state of rest in a vessel to be divided into horizontal layers of the same density, each layer must evidently support the weight of those above it; hence gravity produces internal pressures in a mass of liquid which vary at different points.

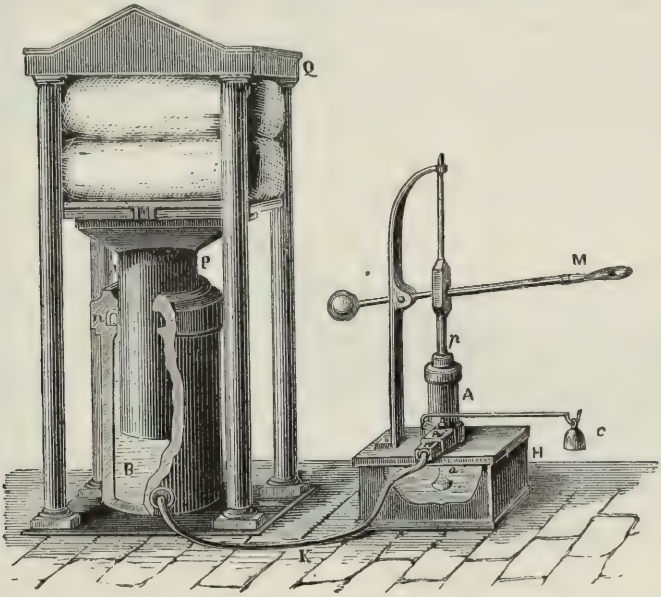


Fig. 23. — Hydrostatic Press.

It has been ascertained that *the pressure in each layer is proportional to the depth.*

With different liquids and the same depth, *the pressure is proportional to their densities.*

The pressure is uniform in each layer. This is as true of *upward* as of *downward* pressure.

The pressure of a liquid upon itself, or the sides of the containing vessel, *depends upon its own depth and density*, but is independent of its quantity or the shape of the vessel.

The pressure of a liquid upon the bottom of a vessel *depends solely upon the area of the base of the vessel and its distance from the surface of the liquid.*

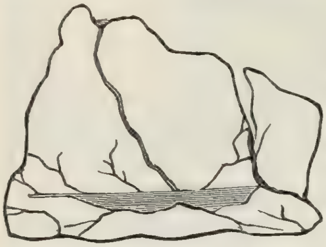


FIG. 24.—Cavities filled with Water.

We sometimes see the effect of this law when long, vertical fissures, connecting with an internal cavity, become filled with water, and large masses are broken off from the sides of mountains by the enormous pressure thus produced.

To find the pressure of a liquid upon the bottom of any vessel, multiply the area of the base by the depth of the liquid, and this result, in cubic feet, by the weight of a cubic foot of the liquid.

To find the pressure of a liquid upon the side of a vessel, multiply the area of the side by one half its whole depth below the surface, and the product by the weight of a cubic foot of the liquid.

138. *Liquids always rise to a level* in a series of connected tubes, no matter what their shape; and it is upon this principle that water is conveyed long distances in aqueducts, or closed pipes, over uneven ground.

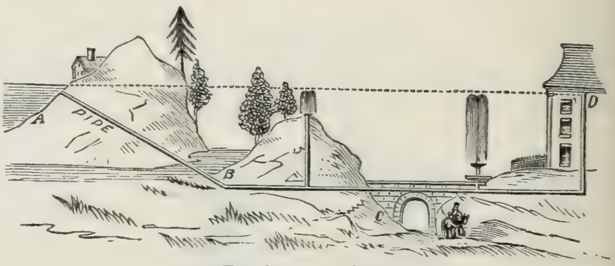


FIG. 25.—Aqueduct.

139. *Artesian wells* depend upon this principle, and in some cases the well has been bored 1,800 feet deep before the vein of water was reached; and in such cases the water has probably, on account of the formation of the layers of stratified rock, come hundreds of miles from the place where it entered the surface of the earth. Canal locks are practical applications of this truth.

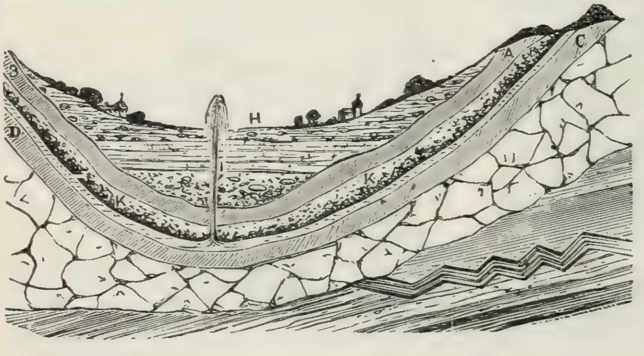


FIG. 26.—Artesian Well.

140. The *spirit level* is based upon the principle that liquids assume a horizontal or perfectly level surface.

CAPILLARY ACTION OF LIQUIDS.

141. Liquids manifest a certain amount of attraction for solid substances, but it is only at minute distances, as in tubes with a hair-like bore, and between the fibres of cloth and coarse paper.

It is by this *capillary action* that candles and lamps give a continuous even light, the oil and tallow furnishing the flame with carbon by capillary action.

The lower story of a house is sometimes rendered damp by this action of water in the pores of the building material.

142. When two liquids of different natures are separated by a partition composed of any porous substance, currents are established between the liquids, called *endosmose* and *exosmose.* The flow of liquid towards that which increases in volume is ENDOSMOSE, and the other current is EXOSMOSE.

143. Some liquids diffuse into one another, or mix, as alcohol and water, notwithstanding their different specific gravities.

144. Graham has originated a process of separation of bodies based on their unequal diffusibility, and he calls it DIALYSIS. The process has received important applications to pharmaceutical purposes.

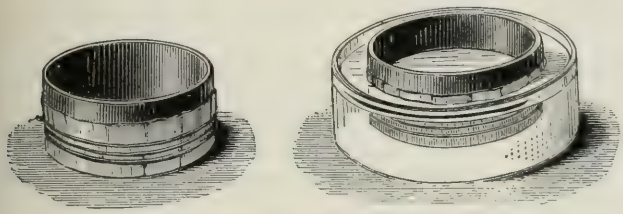


FIG. 27. — The Dialyser.

The DIALYSER consists of a ring of gutta-percha, over which is stretched a sheet of parchment paper, forming a vessel two inches in height and ten inches in diameter.

After pouring in the mixed solution to be dialyzed, the whole is floated on a vessel containing a large quantity of water, and in one or two days almost complete separation will take place. A solution of arsenious acid, mixed with various kinds of food, readily diffuses out of the food.

HYDRAULICS.

145. *HYDRAULICS* treats of liquids in motion, and shows how water is applied as a moving power.

146. *Descending liquids* are governed by the same laws as *falling bodies.* The *velocity* of a liquid issuing from an aperture in the side of a vessel, of whatever shape, *is equal* to that which a body would acquire falling freely through a space *equal to the depth of the middle of the aperture below the surface of the liquid.*

It is expressed algebraically by the formula, $v = \sqrt{2gs}$ as found in article 93, p. 129, on falling bodies; s in this case being height of the surface of water above the aperture: hence v or velocity $= \sqrt{2 \times 32.2 \times \text{the height}}$; or, in words, the theoretical velocity a liquid acquires is found by extracting the square root of the product resulting from the multiplication of the " *head,*" or depth of the aperture below the surface, by 64.4.

To *find the head, the velocity being given*, reverse the above process; that is, square the velocity and divide by 64.4.

To *find the volume discharged* by drains, sluices, brooks, and rivers, of given dimensions, in a given time, *multiply the velocity of the current per second in feet by the area of the cross section of the current in square feet, and the result will be the number of cubic feet discharged per second.*

On account of friction, the *mean* actual velocity will be about two thirds of the theoretical velocity. But when the aperture is a short ajutage or tube, accurately rounded and having the form of the *vena contracta* or contracted vein, the actual velocity will be about .974 of the theoretical.

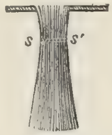


Fig. 28.
Vena Contracta.

147. The *VENA CONTRACTA* is the point of greatest contraction in the volume of a stream of water issuing from an aperture, and is at a distance from the orifice equal to the diameter of the orifice. It is due to the fact that the liquid in the vessel rushes from all sides toward the orifice, thus forming converging currents.

148. The *friction* in long tubes having turnings is so great that large allowances must be made in determining the quantity of water that can be actually delivered at a distance.

If a vessel full of water be allowed to discharge itself, the quantity issuing from an aperture in a given time will be *just half* the amount which would be discharged in the same time *if the vessel were kept full.*

A large allowance must be made for friction in all cases.

The force of currents in streams, canals, and rivers is more or less resisted, and their velocity retarded, by friction.

It is a matter of common observation that the current in the centre of a river is always stronger and of greater velocity than near the banks, and that the velocity at the surface is greater than at the bottom; also that, where a river or stream is contracted in width, the velocity of the current is increased.

The velocity in such case increases as the transverse or cross section diminishes, and diminishes as the area of the section increases.

149. Experiments on the discharge of fluids from reservoirs show, —

That the quantities of a fluid discharged in equal times by the same apertures, from the *same "head," are nearly as the areas of the apertures.*

That the quantities of a fluid discharged in equal times by the same apertures, under *different "heads," are as the square root of the corresponding heights of the surface of the fluid above the apertures.*

That the quantities of a fluid discharged during the same time by different apertures, under different *"heads," are to one another in the compound ratio of the areas of the apertures*, and *the square roots of the heights of the fluid above the centres of the apertures.*

That the discharge from a horizontal cylindrical tube is *increased with the increased length of the tube, until its length is four times the diameter of the aperture.*

That, on the principle of falling bodies, the *discharge by a vertical tube is greater* as *its length is greater.*

That the discharge by an *inclined* pipe is, for the same reason, greater than from a *horizontal* pipe.

That the discharge of a fluid is inversely as the square root of its density.

That the velocity of efflux or discharge increases as the square root of the pressure on the surface of the fluid.

That the greatest mechanical effect of flowing water is obtained by its passage through a circular aperture in a thin plate in preference to a prismatic tube.

DISCHARGE OF WATER IN PIPES, FOR ANY LENGTH AND HEAD, AND FOR DIAMETERS FROM 1 INCH TO 10 FEET, IN CUBIC FEET PER MINUTE.

Diameter.		Cubic Feet per Minute.	Diameter.		Cubic Feet per Minute.	Diameter.		Cubic Feet per Minute.	Diameter.		Cubic Feet per Minute.
Feet.	Inch.		Feet.	Inch.		Feet.	Inch.		Feet.	Inch.	
..	1	4.71	..	5	263.87	2	..	13328.	5	3	148791.
..	1¼	8.48	..	6	416.54	2	3	17889.	5	6	167139.
..	1½	13.02	..	7	612.32	2	6	23282.	6	..	207754.
..	1	19.15	..	8	854.99	3	..	36725.	6	6	253781.
..	2	26.29	..	9	1147.6	3	3	44863.	7	..	305437.
..	2½	46.67	..	10	1493.9	3	6	53995.	7	6	362935.
..	3	73.5	..	11	1894.9	4	..	75392.	8	..	426481.
..	3½	108.14	1	..	2356.	4	3	87730.	8	6	496275.
..	4	151.23	1	3	4115.9	4	6	101207	9	..	572508.
..	4½	194.84	1	6	6493.	5	..	131703.	10	..	745038.

Formula for the construction of the above table is $v = \frac{2356\sqrt{d^5}}{\sqrt{\frac{l}{h}}}$, in which d represents the diameter, and h the height of the fall of the water in feet.

APPLICATION OF TABLE.

150. *To compute the volume of fluid discharged when the diameter and the length of the pipe or sewer and the height of the fall are given.* RULE. — Divide the tabular number opposite to the diameter of the tube by the square root of the ratio of inclination, and the quotient will give the volume required.

EXAMPLE. — The diameter of a pipe is 6 inches and its length is 3,000 feet: under a head of 15 feet, what is the discharge per minute? $\sqrt{\frac{3000}{15}} = 14.1$ = square root of ratio of inclination. Tabular number for 6 inches is 416.54; $416.54 \div 14.1 = 29.54$ cubic feet, discharge per minute.

151. *To compute "head" when the length, diameter, and discharge are given.* RULE.— Divide the tabular number for the diameter by the discharge, square the quotient, and divide the length of the pipe by it; the quotient will give the head necessary to force the given volume of water through the pipe in one minute. Thus, using the elements of the preceding example, $416.54 \div 29.54 = 14.1$; $14.1^2 = 200$; $3000 \div 200 = 15$ feet *head.*

The quantity of water discharged from an orifice in each second will equal in cubic inches the area of the aperture in square inches multiplied by the velocity in inches.

WAVES.

152. *Waves* are the alternate rising and falling of portions of a liquid or fluid, and are produced by some outside force displacing some portion of that liquid or fluid.

The apparent advance of waves in deep water is an ocular deception; and the breaking of waves on the beach or rocks is because the water cannot communicate its undulatory motion to them, hence is itself broken by them. The distance from crest to crest of a wave is the *wave-length.*

When two systems of waves — that is, waves produced by separate causes in different localities — meet, if the crest of one system coincides with that of the other, the resulting wave will be the sum of both; but if a crest of one coincides with a depression of the other, the new wave will equal the difference of the two originals; hence, as like or unlike phases coincide, the waves will be increased, or decreased, or neutralized. This phenomenon is called the *interference* of waves.

153. *The resistance* opposed by liquids to the motion of solid bodies through them varies with the form of the body and the density of the liquid.

In the case of a plane surface moving in a liquid perpendicular to its plane, the resistance is, in general, in proportion to the square of its velocity.

The quantity of liquid displaced by a wedge-shaped body is much less when acting as a wedge than when forced sideways; hence the resistance in the former case will be much less than in the latter.

The form to be given a vessel, in order that the water may offer the least resistance to its advance, and that the vessel may at the same time have a stable equilibrium, is a problem of great moment, and one to which the best mathematicians and experts in naval architecture are giving constant attention.

154. The reason that the paddle-wheel is not more effective in steamers is, that only the paddle which is vertical in the water exerts all its force in propelling, while those in the front and rear of that one are exerting a portion of their force in pressing downward and upward respectively; and in addition to this, when the vessel rolls in a sea, one wheel will be out of the water part of the time, hence cannot act steadily.

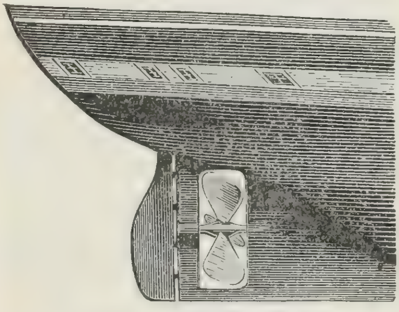


FIG. 29. — Screw Propeller.

155. The *screw propeller* is the best instrument yet made use of in the propulsion of vessels, and it acts on exactly the same principle as does the common screw. If the screw be turned one way in wood, it will draw itself into the wood; and if turned in the opposite direction, it will force itself out of the wood. And in precisely this manner does the screw propeller act, the *rapidity* of its motion in the water supplying the deficiency in density of the medium in which it moves.

WATER-WHEELS.

156. *Water-wheels* in general use are of four kinds, — the *undershot*, the *overshot*, the *breast-wheel*, and the *turbine-wheel*. The *first three* are *vertical;* and the *last*, *horizontal.*

157. In the *overshot-wheel* the water is received at the top of the wheel into buckets, and acts by impact and gravity.

The buckets should be as near together as practicable, and retain the water, as far as may be, until in a vertical position. Curved buckets give the greatest force. A wheel 40 feet in diameter requires, for the best effect, 152 buckets.

158. The larger the wheel the greater the power proportionally, because their centrifugal action is less and the water is retained longer. The ratio of effect to power decreases as the ratio of the *head* to the *total head and fall* increases.

159. A shallow *shrouding* acts more efficiently than a deep one, and is usually ten or twelve inches in depth. The shrouding of a wheel consists of the plates at its circumference which form the sides of the bucket.

160. *To compute the power of an overshot-wheel*, multiply the weight of water in pounds discharged upon the wheel in one minute by the height, or distance in feet, from the centre of the opening in the gate to the surface of the *tail-race;* divide the product by

33,000 (one horse-power), and multiply the quotient by the assumed or determined ratio of effect to power (usually .75); or, for general purposes, divide the product by 50,000, and the quotient is the horse-power.

161. *Breast-wheels* are used for falls of water varying from five to fifteen feet, and are constructed either with ordinary buckets or with blades confined by a curb.

The buckets should be as near together as practicable, — ten to fifteen inches apart, — and so arranged as to leave the water vertical. There should be air-holes in the floor of the buckets, to prevent the air impeding the flow of the water.

The effect of this wheel is equal to that of the overshot, and, in some instances, greater. According to Fairbairn, the opening of the bucket should be to its volume as 8 to 24.

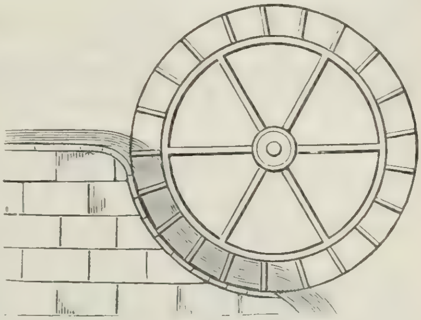


FIG. 30. — Breast Wheel.

162. *To compute the power of a breast-wheel*, proceed as per rule for computing power of an overshot-wheel; using 55,000 and .6 with a high breast, and 62,500 and .6 for a low breast wheel.

163. The *undershot* consists of a wheel with a number of flat boards, called "float boards," fixed on the circumference at equal intervals. When fixed in position, the lower floats are usually set in a curb, with as little space as practicable for the escape of the water; hence a curb concentric to this wheel is most effective. But the undershot-wheel is not an advantageous method of applying water-power.

The rules for construction are nearly the same as for a breast-wheel generally. A curb is the enclosure within which the water flows to the wheel.

164. *To compute the power of an undershot-wheel*, proceed as in rule for computing power of an overshot-wheel; using 93,750 instead of 50,000, and .4 instead of .75.

The mechanical effect of water is the product of its weight multiplied by the height of its fall.

EXAMPLE. — What is the horse-power when a volume of water discharged upon an overshot-wheel is 600 cubic feet per minute, and the height of the fall is 20 feet? $\frac{600 \times 20 \times 62.5}{33000} = 22.73 \times .75$ assumed ratio of effect to power $= 17$ horse-power.

TURBINE-WHEEL.

165. The *turbine* is the most powerful and economical of all wheels. It acts horizontally, and consists of a fixed horizontal cylinder, in the centre of which the water enters from an upright tube or cylinder. The water descending in the tube diverges from the centre in every direction, through curved water-channels or compartments formed in the horizontal cylinder, and escapes at the circumference. Around the fixed horizontal cylinder a horizontal wheel, in form of a ring or circle, is fitted, with its rim formed into compartments exactly similar to the compartments of the cylinder, with the exception that their sides curve in an opposite direction. The water, issuing from the guide curves, strikes against the curved compartments of the wheel, and causes it to revolve.

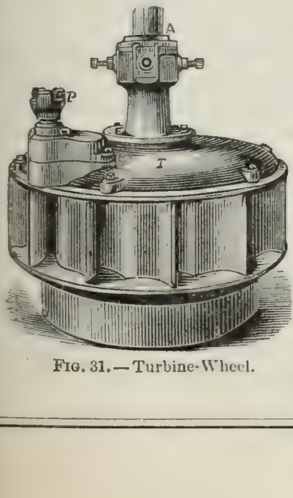


FIG. 31. — Turbine-Wheel.

The wheel, by attachments beneath the fixed cylinder, is connected with a shaft, which passes up through the fixed and upright cylinder and imparts motion to the machinery.

166. In *high-pressure* turbines the reservoir is closed at the top and the water is admitted through a pipe at its side. In *low pressure*, the water flows into the reservoir, which is open.

In order to obtain the maximum effect, the velocity of the water should be the least practicable when leaving the turbine.

The sluice should be wide open to produce the greatest efficiency.

Poucelet's turbine is the most simple of all the horizontal wheels.

Ratio of Effect to Power of the Several Turbines.

Poucelet, .65 to .75 to 1.
Fourneyron, .6 to .75 to 1.
Whitelaw, .6 to .75 to 1.
Jouval, .6 to .7 to 1.
Fontain, .6 to .7 to 1.

167. *To compute the horse-power of a turbine.* Formula: $.0425\ D^2\ h \sqrt{h} = P$.

EXAMPLE.—The diameter of a *turbine* is 8.3 feet, and the fall of water is 16 feet. What is the power? $.0425 \times 8.3^2 \times 16\sqrt{16} = 187.38$ horse-power.

168. ARCHIMEDES' SCREW consists of a tube wound spirally round a solid cylinder, which is inclined at an angle of about 35 degrees, and so fastened at each end as to revolve freely by the turning of a crank at the upper end.

When turned, the open lower end of the tube, being beneath the water, receives some of the water; and, as the revolution continues, the opening becomes higher than the opposite bend in the tube; hence the water continues to flow further into the tube by the force of gravity, and so continues as each successive higher bend of the tube becomes lower than the preceding one, until it flows from the upper end.

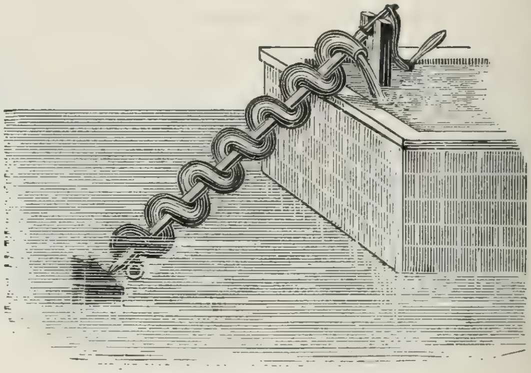


FIG. 32. — Archimedes' Screw.

169. The common *suction-pump*, so called, is a later invention by Ctesibius, an Athenian, and will be considered under *Pneumatics*, as its action is dependent upon atmospheric pressure.

170. The *chain-pump* is only an arrangement for lifting water by means of flat disks or plates on an endless chain, which passes through a tube just large enough to allow the disks to move without much friction. The same principle is applied in grist-mills and grain-elevators.

171. The HYDRAULIC RAM is a machine constructed in a manner to force a column of water upward by suddenly stopping the course of a stream which has acquired considerable momentum; and, on account of the successive impulses and stoppages, it is called a *ram*.

The ram may be used where 18 inches' fall can be obtained. Its power and the height to which it will raise the water, as well as the quantity raised, depend upon, and are proportional to, the volume of the stream and the total head or fall.

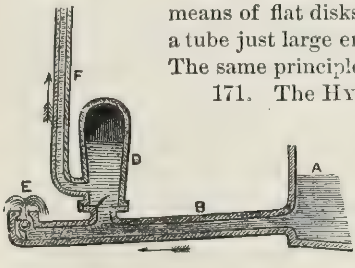


FIG. 33. — Hydraulic Ram.

A fall of five feet in a constant stream may be sufficient to raise a supply for a cistern 100 feet above the ram.

The quantity of water raised, and its elevation, will of course depend upon the distance to which it has to be conveyed; but the ram may be applied to the conveyance of water a distance of 200 rods to an elevation of 200 feet.

The proportion which the quantity raised and the height reached bear to the fall and the volume of the stream is about $\frac{1}{7}$ of the volume of the stream and 5 times the height of the fall.

172. *To ascertain the quantity of water which may be discharged, and the height to which it may be raised, by a given fall and volume of water, when the discharge-pipe is not over 50 rods in length,* —

Multiply the height of the fall by 5 for the elevation, and divide the volume, or the number of gallons discharged by the stream in a minute, by 7 for the quantity.

The size, strength, and weight of the supply and discharge pipes must of course be in proportion to the pressure on them, and this is determined by the *head* or *fall.*

Several small rams are better than one large one to furnish a supply for manufacturing purposes, or where the supply must be constant; for then, if one ram is out of order, the others supply the demand.

173. The result of the water-ram is estimated upon the assumption that a pound of force will raise a pound of water to a height equal to that for which the force is exerted; and of course a less quantity will be raised higher by the same force.

The working results of several rams now in actual use are as follows:—

1st.—	Fall from surface of water in the spring to the ram	10 ft.
	Length of supply-pipe (inside diameter $1\frac{1}{4}$ inches)	40 ft.
	Volume of water discharged by spring per minute	20 gal.
	Length of discharge-pipe (inside diameter $\frac{1}{2}$ inch)	50 rods.
	Elevation of discharge-pipe from ram to cistern	85 ft.
	Amount of water discharged per minute	$2\frac{1}{2}$ galls.
2d.—	Fall from spring to ram	11 ft.
	Length of supply-pipe two inches in diameter	42 ft.
	Length of discharge-pipe (inside diameter $\frac{1}{2}$ inch)	75 rods.
	Elevation of discharge-pipe from ram to cistern	98 ft.
	Discharges 30 barrels of water per day.	
3d.—	Fall from spring to ram	4 ft.
	Length of supply-pipe (inside diameter 1 inch)	60 ft.
	Volume discharged by spring in 10 minutes	25 gall.
	Length of discharge-pipe (inside diameter $\frac{5}{8}$ inch, curved in three places to a semicircle)	190 ft.
	Elevation of discharge-pipe from ram to cistern	19 ft.
	Discharge every 10 minutes	$3\frac{1}{4}$ galls.

PNEUMATICS.

174. *PNEUMATICS* treats of the properties of the air and other gases, and of their motion and pressure.

All gases are subject to the same laws; hence, in treating of air, the most common gas, we discuss the properties of all.

175. GASES are bodies of matter whose molecules have a tendency to separate, and are in a constant state of repulsion; hence they possess perfect mobility, or freedom of movement, and are called *elastic fluids.*

They possess the general properties of solid bodies and all other forms of matter, as impenetrability, compressibility, etc.

Their tendency to fill and assume the form of any vessel in which they are contained is illustrated by putting a bladder half filled with air under the receiver of an air-pump, and exhausting the air from the receiver.

The bladder is immediately fully distended by the expansion of the air within it; and it is generally true that, no matter how large the vessel or how small the quantity of air, the air will occupy every part of the vessel, when the vessel has sufficient rigidity to retain its shape under the pressure of the atmosphere outside; or when, as in the case of the bladder in a vacuum, there is sufficient air to overcome, by its molecular expansion, the weight of the bladder.

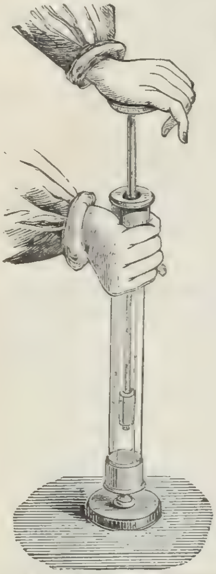


FIG. 34.—Pneumatic Syringe.

176. The *compressibility* of gases is shown by the pneumatic syringe (Fig. 34), which consists of a strong glass tube, closed at one end and furnished with a close-fitting, solid piston. When the piston is pressed upon, the air is compressed by the piston moving into the tube; but as soon as the pressure is removed, the piston is forced back to its former position by the elasticity of the gas, which regains its original volume.

Gases, under the ordinary temperature and pressure, retain their aeriform state; but vapors, which result from the action of heat among the molecules of liquids, as water, alcohol, etc., while they obey the laws of gases, are easily reduced to liquid form again by reduction of temperature and increase of pressure.

177. *That gases have weight* may be easily proven by weighing a vessel of proper form full of air, and again when the air has been exhausted.

The pressure of a gas upon its own molecules, and upon the vessel containing it, may be considered independent of its weight or in connection with its weight.

If we consider only the expansive force of gas, we find that the pressure due to this force acts at all points with the same intensity, both upon the mass itself and the vessel containing it; for it is a necessary consequence of the elasticity and fluidity of gases that the repulsive force between the molecules is the same at every point, and acts equally in all directions, and this fact may be illustrated by the same apparatus used (Fig. 22) to demonstrate this principle in liquids.

178. The law of vertical pressure, considering the weight of gases, is precisely the same as in liquids, and equals in amount the height multiplied by the area of the base of the column; and it is independent of the shape of the cylinder, while the height is the same. For small quantities of gas, the weight may be neglected, but must be considered for large quantities like the atmosphere.

179. THE ATMOSPHERE is the air surrounding the earth, and consists of a mixture of *oxygen* and *nitrogen* gases. The volume of nitrogen is about 78.49 parts of the whole, and the volume of oxygen is about 20.63 parts. About .84 of one per cent of aqueous vapor and .04 of carbonic-acid gas exist in each 100 parts of air.

180. The atmosphere moves with the earth in its rotary motion; otherwise every object on its surface would be destroyed. Our winds are simply the result of local disturbances of greater or less magnitude.

181. The proportion of oxygen to nitrogen in the air is the same in all regions of the earth, at any elevation whatsoever. It is this principle of thorough mixture which makes animal life possible on the earth; for pure oxygen would cause a too rapid oxidation of the animal tissues, and burn them up as really as fire burns wood: but this negative, inodorous, inert gas, nitrogen, so dilutes the oxygen that it destroys the animal tissues only so fast as they can be supplied by the very blood which the oxygen itself purifies by burning.

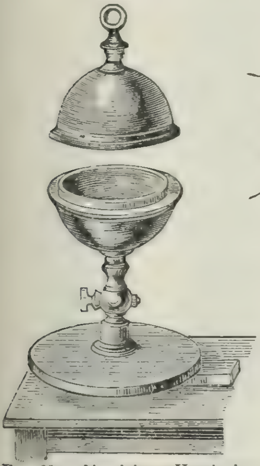
The nitrogen is harmless in itself, but would not support life. This principle of diffusion enables us to perceive at a distance odors arising from the volatile oils of flowers, and various species of vegetation, etc.

182. We have, in speaking of specific gravity and the law of falling bodies, observed that the air, in retarding the fall of light bodies, acted simply as water does on heavy bodies immersed in it; hence it may be considered a fluid sea, in which the earth and all things on it are immersed; and we live in it as fishes do in water.

The reason for the conclusion that has been reached, that the atmosphere is limited in extent, is that the expansive force of the air decreases as it expands, and is further weakened by the low temperature of the upper regions; so that an equilibrium between the expansive force of the molecules of air, and the action of gravity on them, has been established.

The height of the atmosphere has not been determined, though the latest scientific observations estimate it from 198 to 212 miles; but the *ether* which is supposed to pervade all space may be, and likely is, only greatly attenuated air.

183. Since 100 cubic inches of air weigh 31 grains, the whole atmosphere must exercise a great pressure on the earth's surface. This is illustrated by the *Magdeburg hemispheres* (Fig. 35), — the invention of Otto Von Guericke, of Magdeburg, — which are 4 to $4\frac{1}{2}$ inches in diameter. They fit together so perfectly as to be air-tight; and when the air is exhausted, great force is required to pull them apart, although held horizontally, which fact shows that the atmospheric pressure is transmitted in all directions, and not simply perpendicularly.



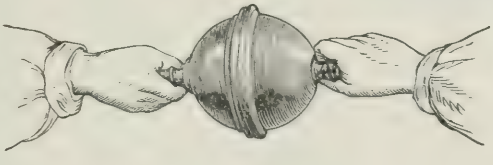


FIG. 35. — Magdeburg Hemispheres.

Torricelli, a pupil of Galileo, in 1643 first made the following experiment, which gives an exact measure of the atmospheric pressure: —

A glass tube is taken about a yard long, and $\frac{1}{4}$ of an inch inside diameter (Fig. 36); it is sealed at one end and filled with mercury; the aperture C being then closed by the thumb, the tube is inverted, and the thumb removed after sinking the open end in a bowl of mercury. The column of mercury sinks somewhat, and finally stops at a height, A, which at the sea-level is about 30 inches.

The mercury remains elevated in the tube by the pressure of air upon the mercury in the bowl, the space in the upper end of the tube being a vacuum; hence the weight of the column of mercury in the tube equals the weight of 1 atmosphere, and it is only necessary to measure the pressure of a column of mercury 30 inches in height to find the weight of the atmosphere in pounds.

Pascal verified the correctness of Torricelli's deductions by using other liquids instead of

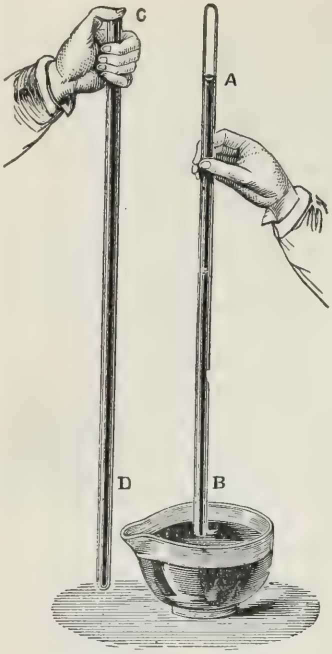


Fig. 36. — Torricelli's Barometer.

mercury, and by using mercury on a high mountain, in which latter case the column in the tube was 3 inches less in height than at the sea-level, thus proving that it is really the atmospheric pressure which supports the mercury.

As a cubic inch of mercury weighs .49 of a pound, 30 inches would weigh 14.7 pounds; therefore the pressure of the atmosphere is about 15 pounds on a square inch. Any body is said to be under the pressure of 1 atmosphere whenever each square inch of its surface has a pressure upon it of 15 pounds.

184. The *common barometer* is only a tube of mercury, like Torricelli's, with a gradual scale on one side to note the variations in its height.

Mercury is generally used in making barometers, because, having a greater density than any other liquid, it stands at a less height under the atmospheric pressure, therefore is more convenient than if of greater length.

185. A *water barometer* would have its column 34 feet high under 1 atmosphere. There are several kinds of liquid barometers, but all are based upon the principle of Torricelli's: that is, the pressure of the atmosphere upon a body of liquid in a vessel containing a tube closed at the upper end and open at the bottom; a vacuum having been formed in the upper end, as before described, or by boiling a quantity of mercury in the tube, to force out all air and watery vapor.

186. Gay Lussac's Siphon Barometer is a bent glass tube, having one branch much longer than the other. The longer branch, closed at the top, is filled with mercury; while the other branch is open to admit the air, and serves as a cistern, upon the mercury in which the air presses.

187. It was observed by Torricelli that the height of the mercurial column varied on different days, and at times on the same day, and that, whenever these changes occurred, a change occurred in the weather; and, from the results of many years' observations, barometers are now usually marked for weather indications.

But, if exact data are wanted, several things must be taken into account: —

1. The temperature, for mercury expands and contracts with different temperatures.

2. The position on the earth's surface with respect to altitude.

3. The position as regards elevation above the sea-level.

4. The maker, and where the barometer was graduated.

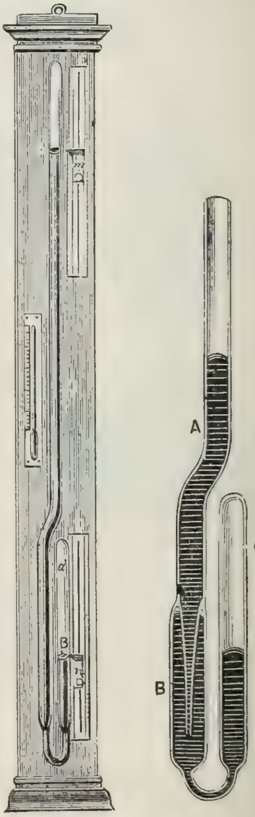


Fig. 37. — Siphon Barometer.

When all the conditions have been duly considered, the barometer becomes a very useful instrument in determining the height of mountains and elevations generally, the condition of the atmosphere, etc.

188. The Law of Compressibility of Gases was discovered by Boyle in 1662, and independently by Mariotte in 1679.

Boyle's law is as follows: —

That the volume of a given quantity of air, the temperature remaining the same, is inversely as the pressure upon it.

That, for a constant temperature, the density and elasticity of air is directly as the pressure it sustains.

Thus, if a given volume of air occupy respectively the spaces $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{100}$, the density and elasticity will be 1, 2, 4, 8, 100.

It has, however, within a few years, been ascertained that gases do not invariably follow this law, but that generally they become less compressible as they near the liquefying point.

The laws governing the mixture of gases are: —

The mixture takes place rapidly, and is homogeneous; that is, each portion of the mixture contains the two gases in the same proportion.

If the gases severally, and the mixture, have the same temperature and occupy the same volume, the pressure exerted by the mixture on the unit of area will equal the sum of the pressures of the gases severally on that unit.

189. Mixture of Gases and Liquids. Absorption. — Water and many liquids possess the property of absorbing gases, but they do not absorb equal quantities of different gases. At ordinary temperatures, water absorbs .025 of its volume of nitrogen; .046 of its value of oxygen; its own value of carbonic acid; and 430 times its own value of ammoniacal gas.

The general laws of absorption, as established by Bunsen, are, —

1. *For the same gas, the same liquid, and the same temperature, the weight of gas absorbed is proportional to the pressure;* that is, at all pressures the volume dissolved is the same.

2. *The quantity of gas absorbed is greater when the temperature is lower.*

3. *The quantity of gas which a liquid can dissolve is independent of the nature and quantity of other gases which it may already hold in solution.*

THE AIR-PUMP.

190. The *air-pump* is an instrument by which an *approximate vacuum* can be produced in a given space, for an *absolute vacuum* cannot be produced by it. It was invented by Otto Von Guericke, in 1650.

As usually constructed, it may be represented by Fig. 38, in which *A*, the *receiver*, is an inverted glass

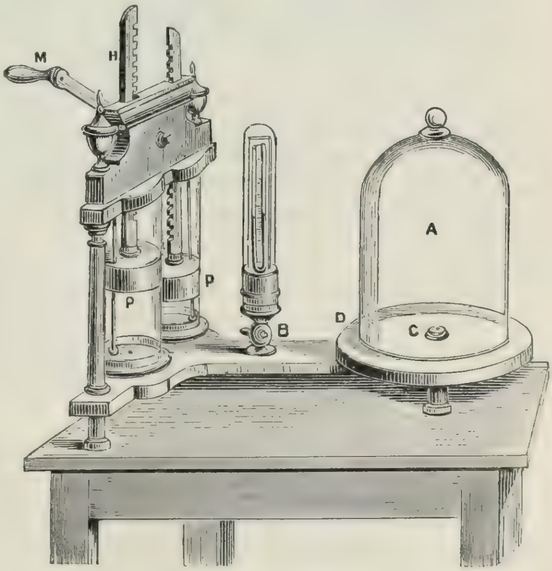


Fig. 38. — Air-Pump.

vessel on a plate, D, to which it fits perfectly air-tight by being ground smoothly. In the centre of D there is an opening, C, through which a communication is made between the interior of the receiver and of the cylinders, P, P, by means of a pipe passing through the body of the plate, B, and branching so as to connect with both cylinders. In these cylinders, which are firmly cemented to the plate B, are two pistons working air-tight, and moved by a rack working with a pinion, H, moved by the turning of the handle M. Each piston has a valve opening upward; and there is also a valve over the opening in the plate underneath, so arranged that when the piston is depressed it will close, while the valve in the piston opens and allows the air in the cylinder to pass out; but when either piston is raised, its valve closes and the valve beneath opens, permitting the air in the receiver to pass into the cylinder by force of its expansion. This alternate action of the pistons, therefore, will cause the air in the receiver to become very much rarefied, but not entirely removed, yet sufficiently so for the uses made of it.

THE SIPHON.

191. The *siphon* is a bent tube, open at both ends, and with unequal legs (Fig. 39), and is used in transferring liquids from one vessel to another. It acts naturally in intermittent springs, as represented in Fig. 40.

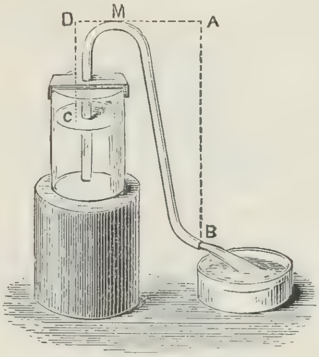


Fig. 39. — Siphon.

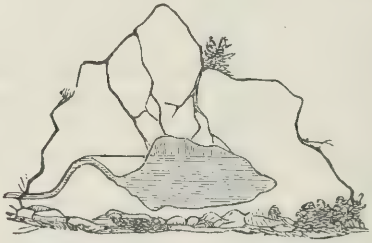


Fig. 40. — Intermittent Spring.

It depends for its action upon the pressure and elasticity of the atmosphere. The principle is the pressure of the air and the weight of a column of water as opposed to the atmospheric pressure only. In Fig. 39, if the air be exhausted from the tube and the water set running from the long end, it will continue to run until the water in the vessel is below the short end of the tube; the column of water in the long end overcoming the pressure of the atmosphere on the water at the opening, and the pressure of the air in the vessel forcing the water into the vacuum thus formed in the tube. The action is the same in springs, only, as shown by Fig. 40, the water must rise in the spring to the height of the bend in the tube before it will begin to run; but having commenced, it will continue until the water in the spring is below the mouth of the inner end of the tube.

SUCTION-PUMP.

192. The *common suction-pump* is based upon the same principle of atmospheric pressure of water through a tube, from which the air has been partially removed by a piston arranged substantially as the piston of the air-pump.

The greatest height at which a piston could work at all would be 34 feet above the surface of the water in the cistern; but, on account of imperfections in construction, the piston should not be over 30 feet above low-water mark in the cistern.

193. A *valve* is a contrivance by which a fluid is allowed free passage through a tube in one direction, but stopped in the other direction.

194. A FORCE-PUMP is an apparatus which adds to the common suction-pump the force of the pressure which may be placed upon a solid piston in its downward movement; thus *forcing* the water raised by atmospheric pressure to any required height, instead of *lifting* it.

This is represented by Fig. 41, in which the piston, by its downward pressure upon the air in the chamber A, forces the water through the pipe D.

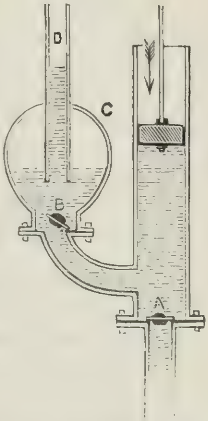


Fig. 41. — Force-Pump.

GASOMETERS.

195. A *gasometer* is a large cylindrical vessel in which gas is collected in gas works for general distribution, and is constructed upon the principle of specific gravity of fluids, — that the lighter will always arrange itself above the heavier when set free in it, and displace it.

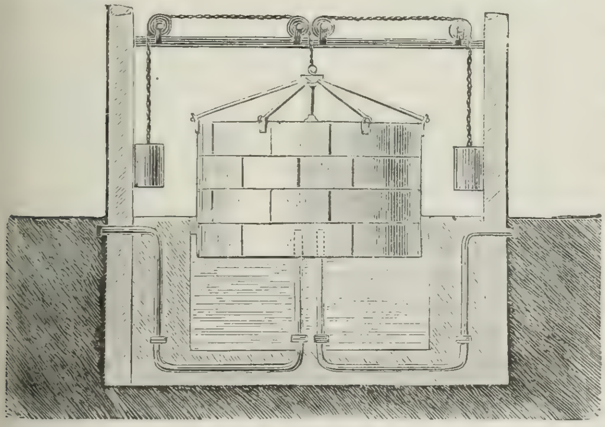


Fig. 42. — Gasometer.

It is represented by Fig. 42, and consists of a cylindrical reservoir suspended, with its mouth downward, by means of weights attached to chains running over pulleys, and sunk in a cistern of water.

A pipe leading from the gas works passes beneath the mouth of the gasometer and admits the gas, which displaces the water and fills the upper part of the reservoir.

Another pipe descends from within the reservoir, and is connected with the service-pipes which supply the gas.

ACOUSTICS.

196. *ACOUSTICS* treats of the properties and laws of *sound.*

197. *Sound* has received a twofold definition, and it is necessary to make use of both in the consideration of acoustics; and the application of each will be readily observed in the course of our discussion of the subject.

Sound is, —

The vibration of the molecules of an elastic body when disturbed by any outside force; or,

The sensation produced in the mind, through the organs of hearing, by the communication of the vibrations of a resonant body to some medium in contact with the ear.

198. The oscillations of the air or any other medium, when acted upon by the vibrating body, are subject to the same laws of movement, increase, decrease, and neutralization

as are undulations in water or waves (Par. 152); and in fact these vibratory motions of any medium are waves of greater or less amplitude or size.

199. The fact of neutralization of sound is neatly illustrated by holding a vibrating tuning-fork over the mouth of a cylindrical glass vessel (*A*, Fig. 43). The air in the vessel will give forth sonorous vibrations and a musical tone. If a second glass vessel be held at right angles to *A*, the musical tone will cease; but, if either cylinder be removed, the sound will again be revived in the other vessel.

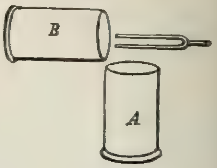


Fig. 43.—Neutralization of Sound.

200. The greater the *amplitude*, the *louder* the sound will be; and the *more rapid* the undulatory motion, the *higher* will be the *pitch.*

I. *The intensity of sound will be inversely as the square of the distance of the ear from the vibrating body.* This will be seen to correspond exactly, as to distance, with the principle of universal attraction.

II. *The intensity will be increased as the amplitude of the wave is increased.*

The near presence of a resonant body to the ear will increase the intensity of sound, because of a renewed production in this body of the original vibrations. This is the reason for the use of sounding-boxes in stringed instruments.

III. *The intensity will be in proportion to the density of the medium immediately surrounding the resonant body.*

Proof of this fact is matter of common observation, as the slight sound produced upon a high mountain by the discharge of a gun, compared to the noise produced by it at the foot of the mountain; or the distinctness with which the scratching of a nail on the end of a long piece of timber may be heard when the ear is pressed upon the other end, compared with the sound when the ear is taken from the timber.

IV. *The intensity is modified by the condition of the atmosphere, and by the direction of the wind.*

201. The transmission of sound through tubes is not governed by the law of intensity as to distance, since the whole vibratory force is confined in case of the tube, and unconfined in open air, where it acts in concentric spheres, the resonant body being the centre of the sphere.

It was found by M. Biot that a conversation in a low tone could be continued at the ends of a water-pipe 1,000 yards long.

202. A *sound-wave*, like a sea-wave, is only an undulation resulting from the action and reaction of one molecule upon another, thus communicating motion from molecule to molecule without permanent change of place.

203. The *velocity* of *sound* should depend on its strength; and a violent sound or vibration ought to be propagated more rapidly than a gentle one, and in many cases this seems to be the fact: yet in musical sounds, as the tunes played by a band, the velocity of different sounds seems to be the same.

204. *The velocity of sound is dependent upon the temperature of the medium*, and increases 13 inches for each degree above, and decreases 13 inches for each degree below, 62° Fahr.

At 62° Fahr. the velocity in air is 1,120 feet per second.

The velocity of light is so great that no appreciable time elapses between the discharge of a distant cannon and the resulting flash; hence, by noting the seconds from the flash until the report, we can determine the distance by multiplying the number of seconds by the velocity of sound.

205. *The greater the elasticity of a medium, the greater will be the velocity of sound.*

206. Since the velocity of sound in gases *is directly as the square root of the elasticity of the gas*, and *inversely as the square root of its density*, it will be the same under any pressure; for the density of a gas under pressure increases in the same ratio as its elasticity, according to Boyle's law (Par. 188).

207. As the *velocity of sound in different gases* which have the same elasticity, but not the same density, varies inversely as the square root of the density, we may obtain it for perfect gases *by dividing the velocity of sound in air*, which at 32° Fahr. is 1,093 feet per second, *by the square root of the specific gravity of the gas*. Thus, for hydrogen it will be $\frac{1093}{\sqrt{.0693}} = 4{,}163$ feet.

208. The *velocity of sound in liquids* may be calculated in a manner similar to the above, by taking for the dividend the velocity of sound in water at 39.2°, and for the divisor the square root of the specific gravity of the liquid.

209. Sound is subject to the same laws of reflection, in respect to its direction, as elastic bodies hereinbefore mentioned (Par. 105. See Fig. 9.)

210. *An echo* is the result of a reflection of a sound in air from some obstacle opposing its movement in a straight line. In order to obtain a distinct echo of words spoken, the person speaking must be not less than 112 feet distant from the opposing object, or the return will be so rapid that the syllables cannot be distinguished. It will at once appear, on trial, that a person cannot utter or hear distinctly more than five syllables in a second; hence, at a distance requiring just $\frac{1}{5}$ of a second for the sound to go and return, words would be distinctly returned, for no more than one syllable would be uttered in that time.

211. *Multiple echoes* occur when there are opposite surfaces at different distances from the person speaking.

There are situations in which as many as 30 repetitions of a sound can be heard; this is the case in a château in Simonetta, in Italy.

Wheatstone, by placing himself close to the upper wall of the Colosseum, found a single exclamation repeated so many times that it appeared like a peal of laughter. The faintest sound is borne from one side to the other of the dome in the whispering gallery of St. Paul's, though not heard at any intermediate point.

212. The *speaking-trumpet* and *ear-trumpet* are based upon the laws of reflection of sound and its conductibility in tubes.

213. The *laws of refraction of sound* are the same as those of light and heat, and will be fully treated under those heads.

214. *Refraction* is a deviation of the lines of motion when sound, light, or heat waves are propagated through media of varying densities and forms.

Thus, the ticking of a watch at a distance, when not heard through the air, may be heard by the interposition of a collodion balloon filled with carbonic-acid gas. The reason is, that a greater quantity of motion is thus communicated to the tympanum or drum of the ear by refraction.

THE PHYSICAL THEORY OF MUSIC.

215. Whenever the vibrations of a sonorous body are equal in time, continuous, and rapid, the result is a simple musical tone. The principal qualities of musical tones are, *pitch*, *intensity*, and *timbre* or *color*.

216. The PITCH is determined by the number of vibrations per second of the sonorous body.

217. The INTENSITY is determined by the amplitude or length of the vibrations. The longest sound-waves capable of producing the sensation of sound are 66 feet, and the shortest are 3.2 inches.

218. The Timbre is the peculiar quality of *tone* that distinguishes a note sounded on one instrument from the same note sounded on another, as in a violin and a flute.

219. When vibrations of the sonorous body are few in number in a stated time, the *tone* is called *grave;* when they are many in that time, the tone is called *sharp.*

220. Musical *tones* are called *notes.* The higher or sharper the note, the more rapid are the vibrations; and the lower or graver the note, the slower are the vibrations.

This may be shown by Savart's wheel (Fig. 44), which is a toothed wheel, B, made to revolve regularly by the wheel A, and the band D. The teeth of the wheel B cause a little strip of card or metal, E, to vibrate, producing sounds.

The number of vibrations in a second may be found by multiplying the number of teeth in the wheel by the number of revolutions of the wheel in that time. In this way may be found the number of vibrations corresponding to any musical note. Two notes are in *unison* when they are caused by the same number of vibrations in the same time.

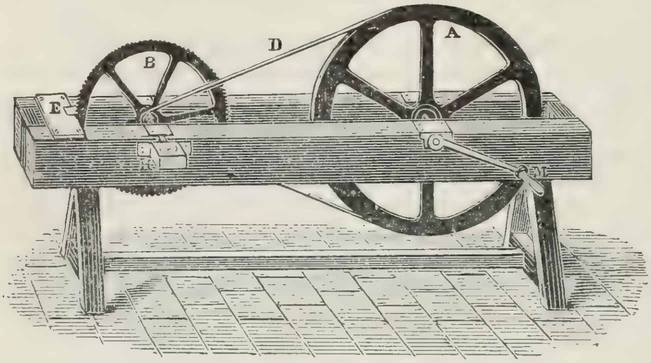


Fig. 44.—Savart's Wheel.

221. The relation existing between two sounds is the ratio between the numbers which represent their respective number of vibrations.

222. If the number of vibrations producing *one* tone is *double* the number producing *another*, the higher tone is called the Octave of the other.

223. A *musical chord* is a combination of harmonious sounds.

224. A *melody* is a succession of harmonious notes.

225. A *harmony* is a succession of chords.

226. A disagreeable effect in mind, produced by two or more notes sounded at the same time, is termed a *discord;* and the opposite effect is termed a *concord.*

227. If we consider musical notes that differ by less than an octave, and take any three resulting from vibrations which are in the ratio 4: 5: 6, these three notes sounded together with a fourth note, which is an octave of the first, constitute a *major chord.*

228. But if the ratio of the vibrations of the three notes is 10: 12: 15, the notes are slightly dissonant, but not sufficiently so to offend the ear under some circumstances; and when sounded with a fourth note, an octave of the lower note, they constitute a *minor chord.*

229. The notes connecting a given note, C, with its octave, C, form the *diatonic scale* or *gamut.* These notes are designated by the letters C, D, E, F, G, A, B,—c, d, e, f, g, a, b. The scale is continued by using the octaves of these notes, as represented by the small letters above. The relations between these are as follows:—

230. *C, E, G,* form a *major triad; G, B, d,* form a *major triad;* and *F, A, c,* form a *major triad.* For this reason C, G, F, have special names, *tonic*, *dominant*, and *subdominant*, respectively. Consequently the numerical relations between the notes of the scale are represented by the proportions:—

$$\left.\begin{array}{l} \mathrm{C: E: G} \\ \mathrm{G: B: d} \\ \mathrm{F: A: c} \end{array}\right\} : : 4: 5: 6.$$

Then, if for comparison we let unity denote the number of vibrations producing C, the number of vibrations producing other notes will be as follows:—

C,	D,	E,	F,	G,	A,	B,	c,
1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{5}{3}$	$\frac{15}{8}$	2.

The intervals between the notes being,—

C to D,	D to E,	E to F,	F to G,	G to A,	A to B,	B to c,
$\frac{9}{8}$	$\frac{10}{9}$	$\frac{16}{15}$	$\frac{9}{8}$	$\frac{10}{9}$	$\frac{9}{8}$	$\frac{16}{15}$

Each interval represented by $\frac{9}{8}$ and $\frac{10}{9}$ is called a tone; and that represented by $\frac{16}{15}$ is called a semitone.

231. For purposes of music, intermediate notes between the notes of the gamut are introduced by increasing or diminishing those notes by an interval of $\frac{25}{24}$. When a note is thus increased, it is called a *sharp;* and when diminished it is called a *flat.*

When the number of vibrations required to produce a note is known, the corresponding wave-length is calculated by dividing the velocity of sound per second by the number of vibrations.

VIBRATIONS OF STRINGS.

232. The vibrations of strings may be either *transverse* or *longitudinal.* The *transverse* vibrations may be produced by striking the string, as in case of a piano; or by pulling, as in the harp; or by drawing a bow across, as in the violin.

233. The laws of the transverse vibrations of strings are as follows:—

I. *The number of vibrations in a second is inversely proportional to the length.*

That is, a string $\frac{1}{2}$ foot long will make double the number of vibrations of one a foot long; and a string $\frac{1}{4}$ foot long, four times the number, etc.

II. *The number of vibrations in a second is inversely as the diameter of the string.*

That is, if one string be twice the diameter of another, it will vibrate half as many times.

III. *The number of vibrations in a second is directly as the square root of the stretching weight of tension.*

That is, if a string produces a number of vibrations when stretched by a weight of one pound, it will require a stretching weight of four pounds to make double the number of vibrations.

IV. *The number of vibrations of a string is inversely as the square root of its density.*

The violin exhibits the operation of these laws in the raising of the pitch of a string by stretching it, or increasing the tension; and in changing the pitch by shortening or lengthening a string by pressing the finger on it; also by using strings of various sizes.

All parts of a string tend to vibrate in the same time; and if a bridge be placed under the vibrating string $\frac{1}{3}$ or $\frac{1}{4}$ or $\frac{1}{8}$ the distance from one end, the remaining portion of the string will divide itself in vibrating into thirds or fourths or eighths, as shown in Fig. 45.

234. **Nodes** are parts of the string which do not vibrate, and which form the divisions of the segments.

235. In *wind instruments,* as the flute, trumpet, organ, etc., the musical sounds are produced by the vibration of air confined within tubes.

In tubes of equal diameter the pitch varies as the length of the vibrating column; and the shorter the column the higher the note.

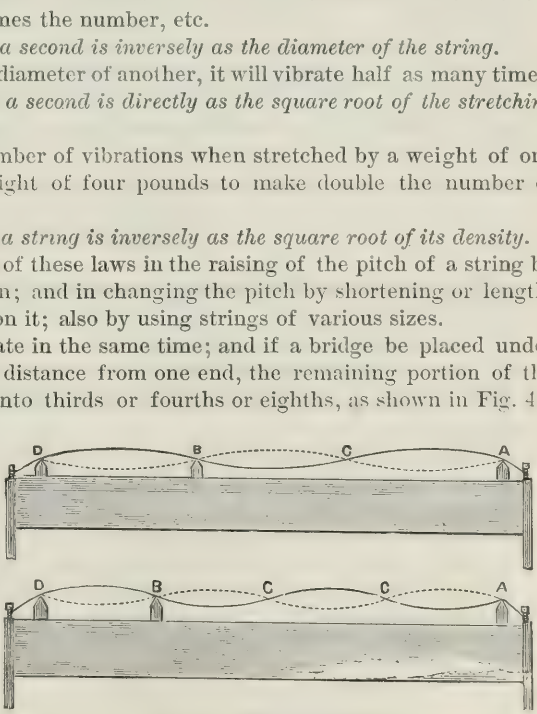


Fig. 45.—Vibration of Strings.

Notes of different pitch are produced in the same instrument by joining tubes of different lengths and diameters, as in the organ; also in a single tube, with apertures at varying intervals, by covering and uncovering the apertures, thus continuing or stopping the vibrations at the point desired, as in the flute.

In tubes of wind instruments, that one which is closed at one end only produces a note twice as low as does the tube which is open at both ends or closed at both ends.

In reed pipes, a simple elastic tongue sets the air in motion; and the tube is used to improve the quality and increase the volume of sound.

236. Benouilli discovered that,—

I. *If a pipe be* OPEN *at the end opposite to the mouth-piece*, then, denoting the primary tone by 1, we can, by gradually increasing the force of the current of air, obtain successively the tones 2, 3, 4, 5, etc., — that is, the harmonics of the primary tone.

II. *If the pipe be* CLOSED *at the end opposite the mouth-piece*, by the same process, the tones 3, 5, 7, etc., would be produced successively; that is, the uneven harmonics of the primary tone. A closed pipe must be half the length of an open pipe otherwise like itself, in order to yield the same primary tone.

It has been ascertained that a sonorous body in a state of vibration exercises an action sometimes of attraction and sometimes of repulsion on bodies near it; and that the vibrations of an elastic medium attract bodies specifically heavier, and repel those specifically lighter, than itself. Thus, a balloon of goldbeater's skin filled with carbonic acid is attracted towards the opening of a resonant box on which is a vibrating tuning-fork; while a similar balloon filled with hydrogen is repelled.

237. The human organ of sound consists of a pipe called the *wind-pipe*, of the *larynx* and the *glottis.*

238. The *larynx* is an enlargement of the upper part of the wind-pipe, and terminates in two lateral membranes, leaving a narrow opening between them called the *glottis.*

The vibration of the edges of these membranes caused by the passage of air is like the vibration of reeds in pipes; and the sound thus produced is modified by the shape of the mouth, and the action of tongue and lips.

PYRONOMICS.

239. *PYRONOMICS* treats of the properties and laws of heat.

240. *Heat*, in a popular sense, has two significations: —

1. It expresses a peculiar sensation.
2. It denotes that state of matter which produces this sensation.

241. Heat as a scientific fact *is a kind of motion in matter*, or is *the force resulting from that motion.*

It will not be necessary to mention in which sense it is used in different places herein, for the sense of the reader will at once make the proper applications of the definitions above given.

The old theory that heat was an imponderable fluid has been entirely exploded, and the *undulatory theory* of motion in matter is an established fact.

242. The *sensation* of *heat* is caused by a very rapid vibration of the molecules of bodies which come in contact with the animal substance, and by the rapid motion of the blood within the individual.

The hottest bodies, then, must be those whose molecules are vibrating most rapidly. This condition, being one of motion, can of course be communicated from one body to another in a manner analogous to that by which sound is propagated.

243. In *solids* the molecules have a vibratory motion about certain fixed positions.

244. In *liquids* the molecules rotate about their centre of gravity, and have no fixed position.

245. In *gases* the molecules are entirely without the influence of mutual attraction, and move in straight lines forward or backward, or in whatever direction an opposing body may force them.

Heat is only one of the phenomena or manifestations of motion in matter. Sound, light, electricity, magnetism, and chemical affinity are other manifestations of motion; and each has its peculiar form of wave or undulation, and may be transformed into the other, or so directed as to produce the other.

Hence we see heat often producing light, as in the sun, the fire of wood or coal, the electric light, and the union of sodium or potassium with oxygen of water when a small piece is dropped upon it. The heat and light in all these cases, except the electric light, have direct relation to chemical affinity.

246. The *density* and *chemical constitution of a substance* determine the result of a certain motion among the molecules: and it may be only heat, or it may be heat accompanied with light; or heat, light, and electricity combined, as in electric light.

247. *Cold* is simply a term denoting a deficiency of heat.

248. *Temperature* is the quantity of sensible heat a body contains.

249. The undulatory theory of heat accounts for the tendency of neighboring bodies to assume the same temperature. This interchange of heat-waves or undulations is called *diffusion of heat.*

The fact that a body weighs no more when heated, even to a high temperature, than when cold, is one of the strongest proofs of the theory that heat is only a mode of motion in matter, and is not itself matter. The old theory that heat was an imponderable substance or fluid was ridiculous on its face; for we cannot conceive of material without weight on the face of the earth, any more than we can conceive of matter without substance. The one implies and necessitates the existence of the other so long as we entertain the principle of universal attraction among the molecules of matter.

Our sensations, when we bring our hands in contact with a piece of iron whose temperature is much below or much above our own, is sufficient confirmation of the undulatory theory. In the one case, the hand being moist, the skin is instantly stuck to the iron by the rapidity of the diffusion of the heat of the hand; and either the hand is frozen, or, if at once taken away, the skin is taken off, and the hand smarts as it does in the other case, when we say the hand is burned. The only difference in these cases is, that in the first the motion is from the hand to the iron, and in the second case it is from the iron to the hand.

250. *Heat*, then, is a *universal motion* or *force*, — a *concomitant of matter*, and likewise indestructible, but like it also in its capability of transformation.

251. *The obvious sources of sensible heat are the sun*, *chemical action*, *electricity*, and *mechanical action;* but *heat-waves*, sensible or insensible, are as eternal as matter itself.

252. When heat undulations are of sufficient rapidity, they result in certain phenomena or appearances, varying with the nature of the matter or medium in which they move. If only a small quantity of carbon be present, as in iron or platinum, the material will simply become luminous, and this we term *luminous heat;* but if a large amount of carbon be present, chemical action will take place, and change of form of the material, called combustion, will result. If gas be set free by the combustion, renewed chemical action takes place; and, as the ignited gas is lighter than the surrounding air, it has a tendency to rise, and the result is *flame.*

253. *Fire* is the phenomenon presented by a union of undulations of heat and light, resulting in combustion and flame.

254. *Burning* is only the rapid oxidation of different substances; and all natural changes in material forms result from a chemical union of oxygen with some of their constituent elements, producing heat undulations. Animal heat is thus produced.

DIFFUSION OF HEAT.

255. There are three modes of propagation of heat undulations, as follows: —

I. By the direct action of the molecules upon each other, called *conduction*, as when one end of an iron rod is kept in a fire until the temperature of the other end has been increased.

II. By the transferring or conveying of the vibrating molecules from one part of a body to another, called *convection*, as when a liquid is placed over a fire.

III. By the transmitting of the molecular vibrations in one body to another through the molecules of an intervening medium. called *radiation*, as a person is warmed by the radiation of heat from a stove.

256. The constitution of bodies determines the amount of heat which can pass through them. *The more porous the body the less its conductivity generally.*

According to Wiedeman and Franz, the *relative conductivity* of metals is as follows: —

Silver	100.0	Steel	11.6
Copper	73.6	Lead	8.5
Gold	53.2	Platinum	8.4
Tin	14.5	Rose's alloy	2.8
Iron	11.9	Bismuth	1.8

VARIOUS SUBSTANCES COMPARED WITH SLATE.

Substance.	Conducting Power.	Cooling Power.	Substance.	Conducting Power.	Cooling Power.
Slate	1.	1.	Hair and lime	1.09	.38
Lath and plaster	.26	.75	Pine wood	.28	.69
Asphaltum	.45	1.06	Plaster	.19	.63
Brick	.6	.97	Stone	.75	.95

257. Asphaltum is the best composition for resisting moisture; and, being a slow conductor of heat, it is best adapted where economy of heat and dryness are required.

258. Slate is a very dry material; but, from its quick conducting power, it is not adapted for the retention of heat.

259. Cements, *plaster of Paris, and woods* are well adapted for the lining of rooms, having low conductive powers; while *hair and lime*, being a quick conductor, is one of the coldest compositions.

260. Fire-brick absorbs much heat, and is therefore well adapted for the lining of fireplaces, furnaces, etc.; while, contrariwise, *iron*, being a high conductor of heat, is one of the worst of substances for this purpose.

261. Common brick is not a very slow conductor of heat: it is 1.8 times higher in the scale than oak wood, and about .027 lower than fire-brick.

262. *The conductivity of liquids is very small*, that of water being only $\frac{1}{95}$ as much as copper; and it is a disputed question whether or not gases have proper conductivity.

263. Whether or not there is in existence, as supposed by some scientists, a fluid or *ether* other than rarefied air of great tenuity, filling all space and even the interstices between the molecules of all substances, does not concern us here: for the fact is established beyond a peradventure that heat is propagated by *wave-motion* from the sun to the earth, and from one body to another on the earth, through the air and other media; and we call the process **RADIATION** as before stated.

The laws of this process are as follows: —

I. *Radiation proceeds in all directions from a heated body.*

II. *Radiation proceeds in straight lines in a similar continuous medium.*

In passing from one medium to another, heat rays or waves are refracted precisely as are the rays of light. The laws of refraction will be discussed in considering the principles of light.

III. *Radiant heat is propagated in a vacuum, as in air.*

It must be remembered that no perfect vacuum has ever yet been formed with a thermometer in it: hence this last rule is only equivalent to saying that heat is radiated in very thin air; and it is extremely doubtful if any other *ether* in this sense exists.

264. *The intensity of radiant heat* is the quantity received on a given surface taken as a unit, and it is modified by the following causes in the proportion stated: —

1. *The intensity* is proportional to the *temperature of the source.*
2. *The intensity* is *inversely* as the *square* of *the distance of the source.*

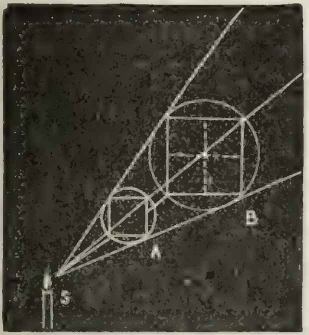


Fig. 46. — Intensity of Heat and Light inversely as the Distance.

The second law follows from the geometrical principle that the surfaces of spheres increase as the squares of their radii. Only a given quantity being radiated in a given time, and the surface of a sphere 2 feet in diameter being four times that of one 1 foot in diameter, the heat furnished a given space in the small sphere would have to be diffused over 4 times that space in the large sphere, hence could have only $\frac{1}{4}$ the intensity.

This will appear in Fig. 46, which also represents the second law of the intensity of light. The inclination of the earth's axis causes the rays of the sun to strike the surface of the earth at different points at different angles, and not always the same at the same point; hence the number of rays upon any given space varies, and the result is our change of seasons.

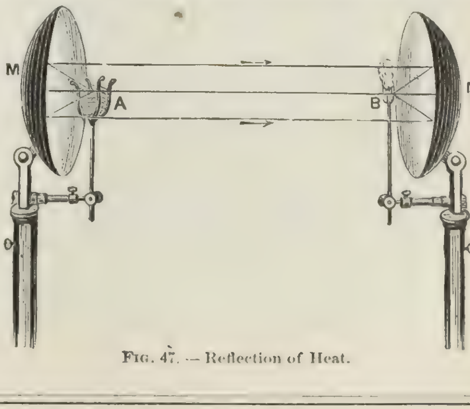


Fig. 47. — Reflection of Heat.

265. When thermal or heat rays strike a smooth, bright surface in a line making an angle with a perpendicular erected at the point of contact, they are reflected from the surface at the same angle (see Fig. 9 for elastic bodies); and the angles are called the *angle* of *incidence* and the *angle* of *reflection.*

The angle of reflection is always equal to the angle of incidence.

This truth is well illustrated by placing a red-hot iron ball in the focus of a concave mirror (Fig. 47), and a small quantity of gunpowder in the focus of another similar mirror placed exactly opposite.

The rays are reflected from the surface

of the first mirror in parallel lines to the second mirror, and thence to the focus of that mirror, causing the gunpowder to explode.

266. The reflecting power of a substance is measured by the proportionate quantity of incident rays it reflects.

The reflecting powers of the following substances have been determined as compared with brass:—

Polished brass	100	India ink	13
Silver	90	Amalgamated tin	10
Polished tin	80	Glass	10
Steel	70	Oiled glass	5
Lead	60	Lampblack	0

White and light-colored clothes are worn in summer because they reflect heat.

It takes longer to heat water in a new tin vessel than in one blackened by use.

267. *The transmission of radiant heat* is the property which substances have of allowing heat-rays to pass through them.

Transparent substances generally transmit heat in proportion to their degree of transparency; but water and alum are exceptions, transmitting but little heat compared with others of the same transparency.

Some substances which are not transparent transmit heat quite freely, as does quartz.

The greater the thickness of the medium, the less number of rays will be transmitted.

The reason why heat-rays pass through some substances which cut off nearly all the rays of light is, probably, that the *heat-waves* more nearly correspond to the arrangement and movement of the molecules of those substances than do *light-waves*. This will be more clearly shown in the discussion of light.

268. *The absorbing power of a body* is measured by the proportionate quantity of incident heat-rays taken into its mass, and it is always inversely as its reflecting power. Hence those bodies which reflect most heat absorb least, and *vice versa*.

Dark-colored substances absorb heat best, and light-colored substances reflect heat best. It behooves people to dress accordingly.

Of material for clothing, wool is the poorest conductor and linen the best conductor. Hence, if we are to be subjected to a heat greater than the natural temperature of the body, woollen would be the best clothing, and it will also be best when we desire to keep the heat of the body from passing off. With the same temperature, we feel colder on a windy day than when the air is quiet, because the heat of our bodies is taken away by fresh currents of air; hence a greater quantity of cold air comes in contact with the body than would by simple convection.

Lampblack is the best known radiator.

269. *Heat causes the expansion of bodies*, because the more rapidly the molecules impinge against one another the greater repelling force they exert; and, as their impinging force becomes less, the body contracts.

The knowledge of the extent of this action, for a given temperature, is made very useful in many practical ways, as hooping casks, and fitting iron bands, and determining the requisite space for sliding joints in steam-pipes, etc.

A table of the expansion of solids has been given (Par. 31).

Liquids expand much more than solids with the same degree of heat, and the force of expansion equals that which would be required to return the expanded liquid to its original volume.

Water increases its bulk $\frac{1}{22}$ when its temperature is raised from 32° to 212° Fahr.

Alcohol, within the same limits, is increased $\frac{1}{9}$.

Water forms an exception to the general law of the contraction of liquids by loss of heat. It contracts and increases in density until its temperature has reached 39.2° Fahr., after which it expands until at 32° it becomes ice, and is lighter than water at 39.2° Fahr. Were this not so, our rivers would be frozen solid.

The expansion of water in freezing is matter of common observation in cold weather, in the bursting of pipes and vessels containing it.

270. Gay Lussac has given the following laws in reference to the expansion of gases: —

I. *All gases have the same coefficient of expansion as air.*

II. *This coefficient is the same whatever the pressure supported by the gas.*

These laws, while not absolutely exact, are so nearly true in the case of permanent gases that it requires great nicety of calculation to detect the error. Considering the relative expansion of gases under the same pressure, the following table exhibits their respective increase of volume as compared with that of liquids, when heated from 32° to 212° Fahr., air being taken as the standard for gases: —

Air............	.365	of its volume.	Sulphuric acid	.06	of its volume.
Steam..........	.365	“ “ “	Mercury	.01815	“ “ “
Water, distilled.	.04775	“ “ “	Oil...........	.08	“ “ “
Water, sea......	.026	“ “ “	Ether	.07	“ “ “
Alcohol	.1112	“ “ “	Nitric acid...	.11	“ “ “

Hydrochloric acid, .06 of its volume.

FUSION.

271. The continuation of expansion of solids by heat beyond the limit of the molecular attraction which holds them in a solid state results in a change of state; and the quantity of heat absorbed or used in effecting that change makes that resultant condition permanent until acted upon by some outside force. This change of state is called *fusion.*

A much greater quantity of motion is required to produce fusion in some materials than in others. Experiments show that the fusion of bodies is governed by the following laws: —

I. *Every substance begins to fuse at a certain temperature, which is always the same for the same substance under like pressures.*

II. *Whatever the intensity of the source of heat, the temperature of the body ceases to rise when fusion begins, and remains constant until the fusion is complete.*

Alloys and fluxes are generally more fusible than any of the metals of which they are composed.

272. The quantity of motion which has been employed in producing the fusion of a substance has been transformed into mechanical action; and as it cannot then be measured by the thermometer, but yet can be evolved and measured by returning the first substance to its solid state, it has been called *latent heat.*

POINT OF FUSION OF VARIOUS BODIES.

	Degrees Fahr.		Degrees Fahr.		Degrees Fahr.
Ambergris melts........	145	Ice melts. ..	32	Potassium melts........	135
Antimony “	951	Iron (cast) “	2100	Saltpetre “	600
Arsenic “	365	Iron (wrought) “	2980	Silver (fine) “	1250
Beeswax “	151	Lard “	95	Spermaceti “	112
Bismuth “	476	Lead “	594	Steel “	2500
Brass “	1900	Mercury “	—39	Sulphur “	226
Copper “	2548	Phosphorus “	108	Tallow “	97
Glass “	2377	Pitch “	91	Tin “	421
Gold (fine) “	2590	Platinum “	3080	Zinc “	740
Gutta-percha softens.....	145				

The expression *latent heat*, though a contradictory term, has been so long used to express the transformed heat of fusion, that it is most convenient to continue its use.

273. A body *dissolves* when it becomes liquid, in consequence of an affinity between its molecules and those of a liquid, as sugar, salt, etc., in water. The result is called a *solution.*

A certain quantity of heat is transformed, or becomes latent, when liquefaction takes place by solution, as well as during fusion; hence the temperature is lowered, except when chemical combination follows the liquefaction. Heat becomes latent by the liquefaction, and is evolved by the chemical action.

274. *Solidification* or *congelation* is the passage of a body from a liquid to a solid state. Every body under a constant pressure, at a fixed temperature which is the same as that of fusion, solidifies. The temperature of the liquid remains constant from the beginning to the end of the solidification. This is on account of the latent or transformed heat becoming free at the moment of solidification.

Solidification may be retarded by first boiling water to expel the air, and then keeping it in a perfectly still place while cooling. Great pressure retards it, as it opposes the tendency of the water to expand on freezing.

Generally, bodies passing slowly from the liquid to the solid state assume regular geometrical forms, as the cube, prism, etc. We call the process *crystallization*, and the forms *crystals.* Quartz, garnets, and rock-salt are examples.

The expansive force of water on solidifying was strikingly manifested in an experiment by Major Williams of Canada. He filled a 13-inch iron bomb with water, and, having firmly closed the hole with an iron plug weighing three pounds, exposed it to a freezing temperature. In a short time the plug was forced out with a loud explosion and thrown 415 feet, and a cylinder of ice 8 inches long was forced from the hole.

Cast iron, bismuth, and antimony expand like water on solidifying, hence can be used for casting.

POINT AT WHICH VARIOUS BODIES SOLIDIFY.

	Degrees Fahr.		Degrees Fahr.		Degrees Fahr.
Ammonia (liquid).........	—46	Nitrous oxide	—150	Spirits turpentine........	14
Blood (human)...........	25	Olive oil	36	Strong wines............	20
Brandy	—7	Proof spirit.............	—7	Sulphuric ether..........	46
Milk	30	Sea-water	28	Vinegar	28

VAPORS.

275. Volatile liquids are those which possess the property of passing into the aeriform state by the absorption of heat from surrounding objects, as ether, alcohol, and water. The aeriform fluids thus formed are called *vapors.*

The fixed liquids, as fatty oils, do not form vapors at any temperature without decomposition. Some solids, as ice, arsenic, camphor, and generally all odoriferous solid substances, can form vapors without first becoming liquid.

The act of passing into vapor is called *vaporization.* The slow production of vapor at the surface of a liquid is usually termed *evaporation;* and the rapid production of vapor in the mass of the liquid is termed *boiling*, as its escape at the surface causes *ebullition.* The laws for the production of vapors are, —

I. *In a vacuum all volatile liquids are instantaneously converted into vapor.*

II. *At the same temperature the vapors of different liquids have different elastic forces.*

When a given space is so filled with a vapor that no more of the liquid will vaporize, it is said to be *saturated.* In this state vapors differ entirely from gases, since for a given temperature they can neither be compressed nor expanded. *Unsaturated* vapors are governed by the same laws of expansion and compression as are permanent gases.

EBULLITION.

276. *Ebullition or boiling* is the rapid production of elastic bubbles of vapor in the mass of a liquid.

When the heating first begins, the small bubbles formed at the bottom move toward the surface of the water, but become condensed by the pressure of the colder layers near the surface; but a movement of the liquid takes place, and, when the temperature of the whole mass has been sufficiently raised, the bubbles reach the surface and burst. The laws of ebullition are as follows: —

I. *The temperature of the boiling point increases with the pressure.*

II. *Under equal pressures, ebullition always begins in the same liquid at the same temperature; but the temperature is different in different liquids.*

III. *Whatever the intensity of the source of heat, as soon as ebullition begins, the temperature of the liquid remains the same.*

BOILING POINT OF VARIOUS SUBSTANCES.

	Degrees Fahr.		Degrees Fahr.
Ammonia	140	Sulphuric acid (sp. gravity, 1.848)	600
Coal-tar	325	“ “ (“ “ 1.3)	240
Mercury	662	Rectified petroleum	316
Petroleum	306	Oil of turpentine	304
Ether	96 to 104	Phosphorus	554
Alcohol (sp gravity, .813)	173.5	Sulphur	570
Nitric acid (sp. gravity, 1.5)	210	Linseed oil	640
“ “ (“ “ 1.42)	248	Sweet oil	412
Sea-salt	224.3	Sea-water	213.2
Common salt	226	Water, distilled	212

The nature of the vessel influences the temperature at which water will boil; and, while it will boil at 212° Fahr. in ordinary vessels, it will require a higher temperature in a perfectly smooth and clean glass vessel, because there are no uneven surfaces to cause an uneven distribution of heat on the bottom; hence the tension of the vapor must be greater before it will overcome the pressure upon it, or rather the pressure must be lessened by further expansion of the water.

As in passing from a liquid to a solid state heat becomes latent in a substance, so it does in passing from the liquid to the aeriform state.

277. The *liquefaction* or *condensation of vapors* is the process of passing from the aeriform to the liquid state, and is effected in case of saturated vapors by reduction of temperature and compression, and in the most rarefied vapors by chemical affinity.

278. *Distillation* is the process of separating a volatile liquid from substances with which it is in solution, and depends upon the different volatilities of liquids, or their vaporization at different temperatures.

MIXTURE OF GASES AND VAPORS.

279. The mixture of a gas and a vapor is dependent upon the following laws:—

I. *The tension and the quantity of vapor which saturates a space are the same for the same temperature, whether this space contains a gas or is a vacuum.*

II. *The tension of the mixture of a gas and a vapor is equal to the sum of the tensions which each would possess if it occupied the same space alone.*

SPECIFIC HEAT.

280. When equal weights of two different substances, as water and mercury, are subjected for the same time to the same temperature under the same conditions, it is found that their temperatures will vary considerably.

Continue applying the heat to the water until it marks the same temperature as the mercury, and then let both cool, and the water will be longer cooling than will the mercury; hence the conclusion that the water requires more heat-rays to raise it to an equal temperature.

The relative amount of heat rays or waves necessary to raise bodies to a given temperature, as compared with some other body, is called *specific heat.*

The unit chosen for comparison is called the *thermal unit;* and it is, in this country, *the quantity of heat necessary to raise one pound of water through one degree Fahrenheit.*

As the elastic fluids expand, their specific heat increases.

281. *Dulong* and *Petit's* law, that the product obtained by multiplying the specific heat of any solid element by its atomic weight is approximately a constant number, is shown in the following table:—

NAME.	Specific Heat.	Atomic Weight.	Atomic Heat.	NAME.	Specific Heat.	Atomic Weight.	Atomic Heat.
Aluminum…………	.2143	27.4	5.87	Magnesium ………	.2475	24	5.94
Antimony…………	.0513	122	6.26	Mercury …………	.0332	200	6.64
Arsenic ……………	.0822	75	6.17	Nickel ……………	.1092	59	6.41
Bismuth ……………	.0308	210	6.47	Phosphorus… ……	.1740	31	5.39
Bromine ……………	.0843	80	6.74	Platinum…………	.0324	197	6.40
Gold ………………	.0324	197	6.38	Potassium…………	.0654	39	6.47
Copper ……………	.0939	63.5	5.99	Silver ……………	.0570	108	6.16
Iodine ……………	.0541	127	6 87	Sulphur …………	.1780	32	5.70
Iron………………	.1138	56	6.37	Tin ………………	.0555	118	6.55
Lead………………	.0314	207	6.50	Zinc ………………	.0956	65.2	6.23

Although the number in the column of atomic heat is not constant, these variations may be due to the difficulty of getting the elements in a state of purity, and to errors in measuring the specific heats and atomic weights; and they are sufficiently near a constant to raise the presumption that —

The same quantity of heat is needed to heat an atom of all simple substances to the same extent.

282. The *temperature* of a body is the greater or less extent to which it tends to impart sensible heat to other bodies.

283. *Thermometers* are instruments for measuring temperature. Liquids are best adapted for constructing thermometers. Mercury is used because it only boils at a very high temperature, and alcohol is used because it does not solidify at the lowest temperature known.

The thermometer consists of a capillary glass tube, with a bulb at one end, partly filled with mercury or alcohol, the air having been expelled from the tube, which has then been hermetically sealed. Great care needs to be taken to obtain a tube of uniform calibre.

In filling the tube, the mercury is put in and boiled until the air and watery vapor have been excluded; then the tube, being full of expanded mercury and mercurial vapor, is sealed.

When sufficient time has been allowed for the tube to be in proper condition, the point at which the mercury stands in the tube when exposed to melting ice is marked for the freezing point, and the point at which it stands when its bulb is in boiling water is also marked; and the intermediate space is then marked off into equal spaces, the number of which will depend upon the scale to be used.

In the centigrade thermometer, 100 spaces are made from zero, or the freezing point, to the boiling point. In Fahrenheit's thermometer, 180 spaces are marked off between the freezing and boiling points; and the boiling point is marked 212° and the freezing point 32°, zero being marked 32° below freezing point.

STEAM.

284. The force with which a vapor expands is called its *elastic force* or *tension;* and this is best illustrated in case of steam. When steam is generated in an open vessel, its elastic force must be equal to the pressure of the atmosphere, — that is, 15 pounds to a square inch, — or it could not form and rise.

Steam always has an elasticity or tension equal to the pressure under which it is generated, and its tension depends upon the temperature of the boiling water, for the temperature of steam is the same as the water producing it: hence, to increase the tension, it must be produced in close vessels, so that its pressure upon the surface of the water will require a higher temperature for the water to boil; and the higher the tension, the higher will be the temperature, and *vice versa.* When the water boils at a very high temperature, the steam produced is known as high-pressure steam; that is, steam condensed, not by withdrawal of heat, but by pressure; and the greater the pressure, the greater the amount of steam in the same volume, and the higher its tension.

ELASTIC FORCE, VOLUME, AND DENSITY OF STEAM AT DIFFERENT TEMPERATURES.

Temperature.	Elastic Force per Square Inch.		Volume.	Density.	Temperature.	Elastic Force per Square Inch.		Volume.	Density.
	In Mercury.	In Pounds.				In Mercury.	In Pounds.		
Degree.	Ins.	Lbs.	Cubic Feet.		Degree.	Ins.	Lbs.	Cubic Feet.	
32	.2	.098	187,407	.0000053	262.6	73.44	36	748	.001337
40.	.263	.129	144,529	.0000069	270.6	83.64	41	664	.00150
50.	.375	.184	103,350	.0000096	272.1	85.68	42	649	.00154
60.	.524	.257	75,421	.0000132	280.5	97.92	48	575	.001739
70.	.721	.353	55,862	.0000179	281.9	99.96	49	564	.001773
80.	1.	.490	41,031	.0000244	289.3	112.2	55	508	.001968
90.	1.36	.666	30,425	.0000329	290.5	114.24	56	500	.002
100.	1.86	.911	22,873	.0000437	291.7	116.28	57	492	.002432
110.	2.53	1.24	16,667	.000059	299.2	128.52	63	449	.002227
120.	3.33	1.632	13,215	.000075	300 3	130.56	64	443	.002257
130.	4.34	2.129	10,328	.000096	301.3	132.6	65	437	.002288
140.	5.74	2.813	7,939	.000125	309.3	148.92	73	393	.002544
150.	7.42	3.636	6,243	.00016	310.3	150.96	74	388	.002577
160.	9.46	4.635	4,976	.0002	311.2	153.02	75	383	.00261
170.	12.13	5.94	3,943	.000253	312 2	155.06	76	379	.002638
180.	15.15	7.42	3,208	.000311	319.3	171.38	84	346	.00289
190.	19.	9.31	2,595	.000385	320.1	173.42	88	342	.002923
200.	23.64	11.58	2,118	.000472	332.	203.99	100	292	.003389
210.	28.84	14.13	1,763	.000567	342.7	234.59	115	259	.003861
212.	30.	14.7	1,700	.000588	349.1	254.99	125	240	.004166
221.2	35.7	17.5	1,440	.000694	352.1	265.19	130	233	.004291
224.2	37.74	18.5	1,377	.000726	360.6	295.79	145	210	.004761
231.2	42.84	21	1,225	.00081	371.1	336.59	165	187	.005347
241.	51.	25	1,044	.000957	380.6	377.1	185	169	.005919
251.6	61.2	30	883	.001132	387.3	408.	200	158	.006329
260.9	71.4	35	767	.001304					

STEAM-ENGINE

285. *Steam-engines* are machines in which the elastic force of steam is used as the motive-power. In ordinary engines the alternate expansion and condensation of steam produces motion in straight lines, which, by mechanical contrivances, is turned into circular motion. Every steam-engine has apparatus for the production of steam, and an engine for its application.

A *low-pressure* engine is one in which the pressure does not much exceed one atmosphere; and a high-pressure engine is one in which the steam pressure is equal to a number of atmospheres. Low-pressure engines are usually *condensing* engines, where the steam is condensed after its action in expanding has ceased.

High-pressure engines are usually without a condenser, as the locomotive.

The *double-acting* or *Watt's steam-engine* is represented in the accompanying figure, and is called *double-action engine* because the steam acts alternately above and below the piston.

It was invented by James Watt, at Glasgow, Scotland, in the year 1768.

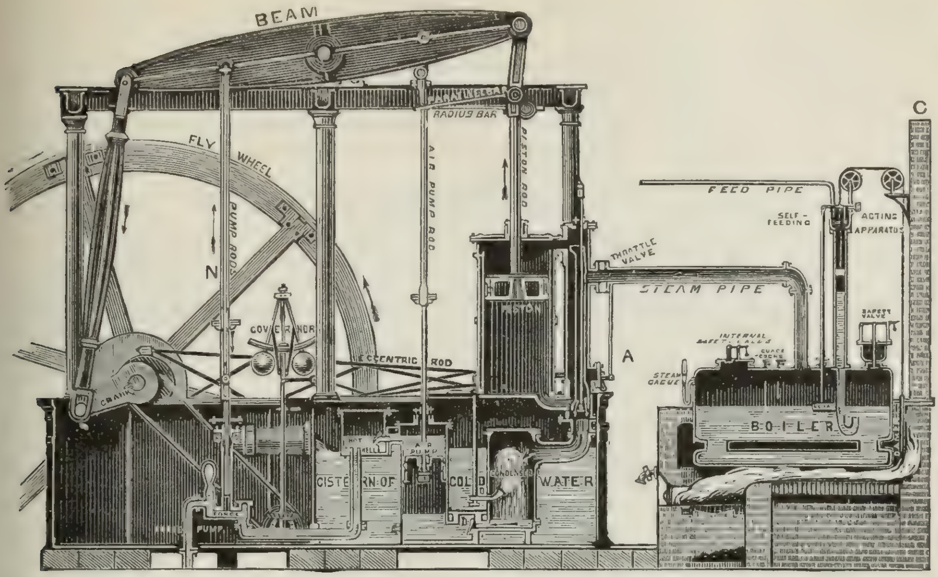


Fig. 48. — Steam-Engine.

Fig. 48 shows a vertical section of the boiler and engine in connection with the several important parts named.

The *boiler* is frequently made, with two small horizontal cylinders beneath it, next the fire, connected by tubes.

These cylinders are called *heaters* and are quite full of water, while the boiler is only half full. By this means there is less danger of the water becoming low enough in the boiler to cause an explosion; and at the same time, by means of flues which divide the furnace into two horizontal compartments (enclosed on all sides by bricks), a greater heating surface is obtained.

When the water in the boiler gets too low, the float within sinks with the water and opens a valve, letting out the steam, which, in escaping, strikes against a piece of thin metal, causing a shrill sound.

This arrangement is called the *safety-whistle.*

The *safety-valve* consists of a valve held down over an opening by a weight at the end of a lever, as shown in the figure. The lever is so weighted that, when the pressure within is equal to a given standard (six atmospheres, more or less), the valve rises and the steam escapes.

The smoke, cinders, etc., pass out of the chimney, C.

Water is admitted to the boiler through the feed-pipe.

The steam-gauge shows the tension of steam in the boiler.

The steam flows through the steam-pipe into the cylinder, alternately above and below the piston, as the sliding-valve permits.

The *piston* working up and down — as it is enabled, by the alternate condensation of the steam above and below it (after performing its work), by the jet of water in the condenser — carries with it a piston-rod, connected with a parallel bar and joint so as to communicate an upward and downward motion to the beam, which is connected with the crank in such a manner as to impart its motion to the horizontal shaft which puts any machine connected with it in motion, either by wheels and bands or wheels and rods.

The *fly-wheel* regulates, by its momentum, the motion of the crank when it is at its *dead points* and the piston is at the top or bottom of the cylinder.

The *air-pump rod* works the piston in the cylinder of the air-pump, in connection with the condenser into which the cold water is injected, and pumps the heated water from the condenser into the reservoir or hot-well.

N is the rod of the *cold-water pump*, which supplies the water for the condensation of steam.

A is a bent lever which imparts the motion of the *eccentric-rod* to the *sliding-valve* of the steam-cylinder, by which the steam is admitted above and below the piston alternately.

The *governor* consists of two heavy balls, connected by jointed rods with a revolving perpendicular axis. When the axis is made to revolve rapidly, the balls are separated by their centrifugal force. This separation draws down the jointed rods, which, by connection with the steam-pipe, shut off or admit steam as it is needed.

286. *Locomotives* are steam-engines which propel themselves by transmitting motion to the wheels on which they are mounted.

The principal parts are the *framework*, the *fire-box*, the *casing of the boiler*, the *smoke-box*, the *steam-cylinders* with their valves, the *driving-wheels*, and the *feed-pump*.

The motion of the pistons is transmitted to two large driving-wheels by two connecting-rods, which, by means of cranks, connect the piston-rods with the axles of the wheels.

The alternating motion of the slide-valves is produced by means of eccentrics placed on the axles of the large wheels.

WORK OF AN ENGINE. HORSE-POWER.

287. The *work* of an engine is measured by the mean pressure of the piston multiplied by the area of piston and by length of stroke.

288. In England and America the *unit* of *work* is the *foot-pound;* that is, *the work performed in raising a weight of* 1 *pound* 1 *foot high.*

To raise a weight of 10 pounds 15 feet high would require 10 × 15 = 150 foot-pounds.

289. The *rate* of work in machines is the amount of work performed in a given time. The rates of work are compared by means of *horse-power*, which is *an agreed-upon unit*, and represents 33,000 *foot-pounds per minute;* that is, the work necessary to raise 33,000 pounds one foot high in a minute.

290. *To compute the horse-power of an engine*, multiply the velocity of the piston in feet per minute by the square of the diameter of the cylinder in inches, and divide the result by 1,000 for the horse-power of a *non-condensing* engine, and by 1,400 for a *condensing* engine.

GENERAL RULES.

291. The *thickness of a vertical steam-cylinder may be found* by multiplying its diameter by the extreme pressure of steam in pounds per square inch to which it may be subjected, and dividing the product by 2,400. For *horizontal* cylinders, divide product obtained as above by 2,000.

292. The *journals of shafts* should have a length of 1.15 to 1.54 times their diameter.

293. The *area* of the *steam-pipe* should exceed that of the steam-valve.

294. The *length* of the *connecting-rod* should be 2.25 times the stroke of the piston, when the space can possibly be given.

The *comparative friction* for connecting-rods is, for once the length of piston stroke, 12 per cent additional; twice the length, 3 per cent; and thrice the length, 1.33 per cent.

LOCOMOTION.

295. PROPORTION OF PARTS BASED UPON DIAMETER OF CYLINDER.

Crank-shaft, diameter	.4	Depth of piston	.28
Connecting-rod, end diameter	.16	Blast-pipe, diameter	.3
Connecting-rod, middle diameter	.21	Area steam part	$d^2 \times .08$
Piston-rod, diameter	.15	Area exhaust part	$d^2 \times .28$

Heating surface should be 70 to 85 times the *grate* surface.

Area of tube surface should be 10.5 times the *furnace* surface.

THICKNESS OF BOILER-IRON REQUIRED AND PRESSURES ALLOWED BY THE LAWS OF THE UNITED STATES.

Pressure equivalent to the Standard for a Boiler Forty-two Inches in Diameter and One Fourth of an Inch Thick.

WIRE GAUGE.	THICKNESS IN 16THS.	DIAMETER.						
		Thirty-four Inches.	Thirty-six Inches.	Thirty-eight Inches.	Forty Inches.	Forty-two Inches.	Forty-four Inches.	Forty-six Inches.
Number.		Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.	Pounds.
1	5	169.9	160.4	152.	144.4	137.5	131.2	125.5
2	4½	158.5	149.7	141.8	134.7	128.3	122.5	117.2
3	4¼	147.2	139.1	131.8	125.1	119.2	113.7	108.8
4	4	135.9	128.3	121.6	115.5	110.	105.	100.4
5	3⅔	124.5	117.6	111.4	105.9	100.8	96.2	92.1
6	3⅓	113.2	106.9	101.3	96.2	91.7	87.5	83.7
7	3	101.9	96.2	91.2	86.6	82.5	78.7	75.3

296. In order to receive the best effects from fuel, the emission of gases from the furnace should be retarded to complete combustion under high temperature; hence the grate surface should be large, to induce a slower current.

A hot boiler should never be filled with cold water, nor blown out until cool.

To avert danger from intense heat, to save fuel, and keep up a free circulation, engineers should adjust the injector so that the boiler will lose a little water while running between stations.

If the injector is kept at work during stoppages, this loss will be compensated, and a full supply always kept up, absorbing the surplus heat and preventing explosion.

297. AVERAGE RUNNING TIME.

On English Railroads.	Name of Road.	Distance.	Average Speed per Hour.
London to Swindon (Broad-Gauge Express)	G. W.	77¼	53¼
London to Peterborough	G. N.	76¼	50¾
York to Newcastle	N. E.	87	49¾
Grantham to York	G. N.	83	47½
Newcastle to Berwick	N. E.	66¾	47
London to Dover	S. E.	78	44½
London to Rugby	L. & N. W.	82¾	43¾
Carlisle to Preston	L. & N. W.	89	38⅔
On American Railroads.			
Baltimore to Washington (Limited Express)	B. & P R. R.	40	60
Bound Brook to Elizabeth (Bound Brook route)	N. J. C.	....	56
Jersey City, N. J., to West Philadelphia, Pa.	Penn. Cen.	88½	52 1-5
Jersey City, N. J., to Philadelphia (Bound Brook route), 4 regular stops included	N. J. Cen.	89	48
New York to Washington (Limited Express), 1½-hours of stops included	Penn. Cen.	232	40

HEATING.

298. *Heating* is the utilizing the various sources of heat for domestic and industrial purposes.

The most common source of artificial heating is the combustion of carbon in its various forms, as coal, coke, charcoal, wood, and oils.

The less common, because more costly, sources are electricity and the chemical action of acids, alkalies, and metals.

The methods of using these sources are various,—by an open fire, as in a grate; by a close fire, as in a stove; by hot air; by steam; and by hot water circulating in pipes.

The most healthful method of heating is an open fire, for better ventilation results.

The most even temperature is obtained by heating through the circulation of heated fluids in pipes; but this method is not so healthful, as it does not aid in air circulation, in the rooms heated, like an open fire.

With open fires or stoves, the chimney is the chief means of ventilation; and on account of the higher temperature and lighter weight of the air in the chimney, it rises and gives place for an inflow from the room; hence space in the room is given for an influx of fresh air.

The chimney will be a good one in proportion as it satisfies the following conditions:—

I. The internal diameter of the chimney ought not to be larger than is necessary to allow the products of combustion to pass out freely, or a descending as well as an ascending current will be established in the chimney, and smoke will be forced into the room.

It is advantageous to place a conical pot, narrower than the chimney, on its top, in order that the smoke may escape with sufficient velocity to resist the action of wind.

II. The chimney ought to be of considerable height, for the draught is caused by the pressure of air in the room exceeding that in the chimney; and the longer the column in the chimney (if not so long as to reduce its temperature greatly) the greater the difference of pressure.

On this principle *very* high chimneys are used in mills and factories.

III. The external air should be admitted to the room with sufficient rapidity to supply the required oxygen to support combustion. The amount required will depend upon the kind of fuel.

In perfectly close rooms, either the fuel would not burn, or descending currents would be formed in the chimney and force smoke into the room. Usually air will enter in sufficient quantities at the crevices of doors and windows.

IV. Two chimneys should not communicate, for a descending current is liable to be established in the one which may have less length or greater size.

299. *Relative weight of air required for combustion of* 1 *pound of fuel.*

Anthracite coal	12.13 lbs.	Charcoal	11.15 lbs.
Bituminous coal	10.98 "	Coke	11.28 "
Peat (dry)	7.08 "	Wood (dry)	6 "

300. *Volume of air required for combustion of* 1 *pouud of the wood.*

Pine	158 cubic ft.	Oak	154.4 cubic ft.
Birch	153 "	Beech	152.9 "

301. All woods heated away from air yield their watery vapor, and remain nearly pure charcoal. More than ⅓ by weight, and frequently ½, of green wood is water, the amount depending in a measure upon the time of cutting. All kinds of wood cut in January have 15 and some 25 per cent less water than if cut in the spring, after the sap is in vigorous motion. It therefore behooves all interested in the production of heat by wood to ascertain when the wood was cut, whether it has been kept under cover or exposed to rain, and whether it has been subjected to a drying process or not.

Green wood, before it can furnish heat for any useful purpose, must have heat enough employed to evaporate its own water; hence it is very poor economy to burn green wood. Not only is it wasteful in itself, but injurious to the stove or furnace in which it is burned, for it effects more rapid oxidation of the iron. In addition to this, the cost of hauling or transporting two times the necessary weight of material is not a small item of loss.

The following tables show the relative value of various seasoned woods for fuel and the generation of steam, and their relative money value, taking hickory at $5.00 per cord as a basis: —

TABLE SHOWING VALUE OF DIFFERENT SUBSTANCES FOR HEATING PURPOSES.

NAME.	Pounds of Dry Wood in 1 Cord.	Pounds of Charcoal from 1 Cord of Dry Wood.	Pounds of Water Heated 1° by 1 Pound of Substance.	NAME.	Pounds of Dry Wood in 1 Cord.	Pounds of Charcoal from 1 Cord of Dry Wood.	Pounds of Water Heated 1° by 1 Pound of Substance.
Shellbark hickory	4,469	1,172	6,960	White elm	2,592	644	4,900
White oak (kiln-dried)	3,821	826	5,960	Yellow pine	2,463	585	4,872
White ash	3,450	888	5,612	Chestnut	2,333	590	4,920
Apple-tree	3,115	779	5,411	Poplar	2,516	549	4,500
Red oak	3,255	630	4,928	Butternut	2,534	527	4.460
Black walnut	3,044	687	5,111	White birch	2,369	450	4,340
White beech	3,236	635	4,848	Pitch pine	1,904	510	5,466
Black birch	3,115	604	4,740	White pine	1,868	455	4,620
Hard maple	2,878	617	4,808	Alcohol	....	....	11,000
Olive oil	....	....	14,500	Beeswax	....	....	14,000
Tallow	....	....	15,000	Coke	....	....	9,110
Coal, anthracite	....	....	9,560	Coal, Welsh	....	....	11,840
" Newcastle	....	....	9,230	" Cannel	....	....	9,000
Peat	....	....	3,250				

Relative Money Value per Cord.

Hickory	$5.00	Black walnut	$3.25	Wild cherry	$2.75
White oak	4.05	Black birch	3.15	Soft maple	2.70
Red oak	4.45	Hard maple	3.00	Yellow pine	2.70
White ash	3.85	White elm	2.90	Chestnut	2.60
Apple-tree	3.50	Red cedar	2.08	Butternut	2.55
White beech	3.25	White pine	2.10	White birch	2.40

METEOROLOGY.

302. *METEOROLOGY* treats of the atmosphere and its phenomena, especially in its relation to heat and moisture.

303. By *climate* is meant the local conditions of a certain tract of country as affected by the temperature, moisture, and motion of the atmosphere.

304. The *temperature* is determined by observing the standing of the thermometer at stated intervals of day and night throughout the year, and making an average for the year of the mean daily temperatures. While the daily temperatures of any place for different years vary more or less, the average annual temperature is nearly constant.

The conclusion thus reached from long and careful observations is that the same quantity of heat is annually distributed over the earth's surface, and that each place receives a nearly constant amount in successive years.

The average temperature diminishes from the equator to the poles, because the sun's rays fall more obliquely the greater the distance of a place from the equator; hence, if the surface of the earth were a perfect plane, all places of the same latitude would have the same temperature, the same amount of moisture, etc., and therefore the same climate. Owing, however, to the conformation of the land and configuration of the continents, and the resulting differences of moisture, temperature, and motion of the atmosphere,— as well as reflection of heat-rays of the sun by hills and mountains, and the character of the soil, — the climate is very different at places having the same degree of latitude, and only a few miles apart even.

305. Air always contains a certain amount of watery vapors, and its capacity for moisture depends upon its temperature. It is said to be saturated when it can hold no more at a given temperature. In this condition, a very slight motion or reduction of temperature will cause a condensation of the vapor, and its deposit in the form of drops of rain or dew.

Air is said to be dry when water evaporates rapidly, and it is called damp when moistened surfaces dry slowly. But the air which is termed *dry* may contain much more moisture than that which is said to be *damp*.

306. For indicating the true humidity or moisture of the atmosphere, the terms *absolute* and *relative* are used.

Absolute humidity represents the actual quantity of moisture in a given volume of air.

Relative humidity is its nearness to saturation: hence it depends upon absolute humidity and temperature; for a given volume of air will pass from a state of dampness to extreme dryness by the elevation of its temperature, without losing a particle of its moisture. The aqueous vapor prevents a too rapid radiation of heat from the earth's surface, and thus acts as a warm covering and a moderator of temperature.

Instruments for measuring the moisture of the atmosphere are called *hygrometers.*

Many bodies absorb vapor, and thus increase their dimensions. Any one of these, as wood, whalebone, ivory, etc., so arranged as to register its change in volume, would be a hygrometer. Regnault's condensing hygrometer is the best in use.

307. *Dew* is the condensed vapor of the air, and is produced by the contact of the air with colder bodies. The temperature at which dew begins to be deposited is called the *dew-point.* This point is not always the same; for the air has not always the same amount of vapor in proportion to its volume, hence would not always be saturated at the same temperature.

When *saturation* is complete, the least reduction of temperature results in dew deposit. Dew is always deposited upon the outside of a pitcher of ice-water in a warm room.

As we have seen, all bodies do not radiate heat with equal rapidity; hence some bodies remain perfectly dry, while others are covered with dew: thus grass, wood, and leaves — radiating heat freely — will be covered with dew, while polished metals and smooth stones will be perfectly dry.

Dew is deposited most freely upon a calm, clear night, as then the radiated heat of the earth is not reflected or radiated back as when it is cloudy. When the wind blows hard, no dew is formed, because of the evolution of heat by friction, and the temperature is not lowered. Dew does not fall, as is commonly thought, but is formed from the vapor in the air in immediate contact with the body on which it is deposited.

When the temperature upon a clear night falls below the freezing point, the deposited dew is frozen, and is called *frost.* A very slight covering will keep plants from injury by frost, as it prevents in a measure the radiation of heat.

CLOUDS, RAIN, SNOW, AND HAIL.

308. When vapor is partially condensed *at a distance* from the surface of the earth, it presents an appearance called *cloud;* but when it is thus condensed *near* the surface, but not to such an extent as to form drops, it is called *fog* or *mist.*

We often see a mist rising from the water of a pond or lake just after sunrise, when the surface of the water is warmer than the air just above it. It is only a condensation, by the cold air, of the vapor which evaporates from the water's surface. The same result occurs in winter, when we see the vapor exhaled from the lungs of animals and frozen on their hair.

A cold wind blowing suddenly over any region condenses the invisible vapor into cloud; and if the air is at all near saturation, rain follows. A warm wind, by absorbing vapor, tends to disperse clouds.

The formation of clouds about mountain summits is caused by the condensation of the humid air that has been passing up their sides from the valleys.

309. The *cirrus* is the name given to a cloud which appears during fine weather in thin, feathery lines and streaks, at great elevations.

310. The *cumulus* is the name given to large, rounded masses of vapor, that look like mountains of snow in the sunshine.

These clouds appear in greatest numbers near the middle of fine summer days, because then the currents of warm air are more rarefied and rise higher; but, as toward night the air becomes cooler, these clouds sink nearer the earth, and are partially or wholly absorbed by the warmer layers of the lower atmosphere.

311. The *stratus* is the name given to horizontal streaks or layers of vapor which float at lower elevations, and frequently exhibit great brilliancy of color at sunset, on account of the partial decomposition of the sun's rays of light, similar to that which occurs in the rainbow.

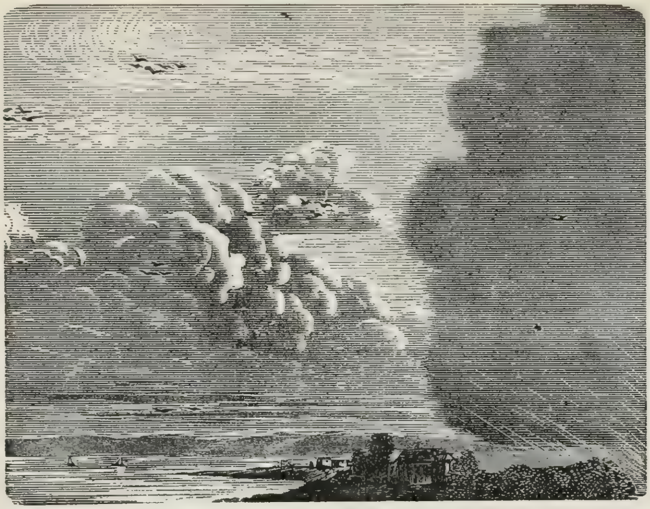


FIG. 49. — Clouds.

⌣, Nimbus; ⌣⌣, Stratus; ⌣⌣⌣, Cumulus; ⌣⌣⌣⌣, Cirro-cumulus; ⌣⌣⌣⌣⌣, Cirrus.

312. The ***nimbus***, or rain cloud, has no distinctive form, but usually covers the whole horizon and presents a bluish-black appearance.

313. *Rain* is the condensation of the vapor to such an extent that it forms drops of water which fall by the action of gravity. The condensation of vapor is dependent upon the law that the capacity of the air for moisture decreases more rapidly than its temperature decreases.

Rain falls more frequently in the temperate zones than in the tropics, because in the former the winds are more variable and the temperature less constant. But, though it rains *oftener* in the temperate zones, the fall of rain is only a little more than $\frac{1}{3}$ that of the tropics; for in the latter the fall of rain is much greater in a given time.

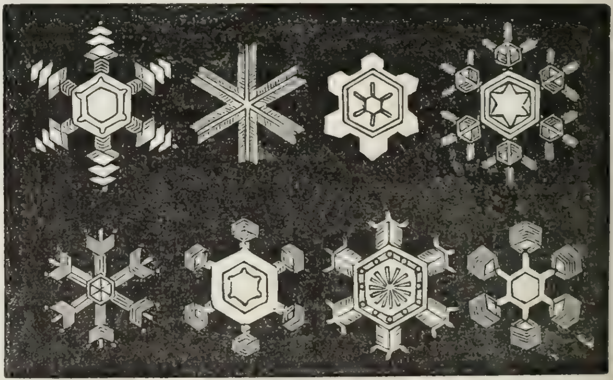


FIG. 50. — Stellate Snow Crystals.

314. *Snow* is the condensed vapor of the air frozen as it is precipitated.

315. Drops of water, when rapidly condensed in large quantities and frozen in the act of falling, produce *hail.*

Arago has exposed the fallacy of the prevalent belief that the influence of the moon changes the weather with each change of phase, or from lunation to lunation, by showing that the barometer is not affected thereby, and that aerial tides, at their highest and lowest points, indicate only the difference of pressure of $\frac{1}{30}$ and $\frac{1}{40}$ of an inch, which would be utterly insignificant in result.

OPTICS.

316. *OPTICS* treats of the phenomena of *light* and vision. Light, by its action on the retina of the eye, excites the sensation of vision.

As in heat and sound, so in case of light the established theory is, *that it is only a kind of motion in matter*, and differs from heat only in the length or form, and rapidity of material vibrations; hence, like heat-waves, it passes without interference through some substances, but is *diffracted*, *refracted*, *reflected*, or *neutralized* in others, according as their motion corresponds to, or differs from, that of the medium in which the light is propagated.

As we remarked in speaking of the means of the propagation of heat, the general theory is, that an *ether* of infinite tenuity prevades all matter, and that by its undulations light is transmitted.

But as there is no proof whatever of the existence of any ether other than rarefied air, and as light is transmitted through the air at the surface of the earth with the same rapidity that it is through the interstellar spaces or from planet to planet, we think it unnecessary to suppose the existence of a substance no better for our purpose than the air itself, especially as we find air in all the interstices of solid or liquid bodies.

317. Like sound and heat, the *intensity* of light is greater as the amplitude of the undulations is greater.

318. The *color* of light depends upon the length of the undulations producing it; and as in sound the vibrations may be so rapid that the human ear cannot detect them, so with light the vibrations may be so rapid that the human eye will not perceive them, as in the case of *actinic* rays.

It has been determined by experiment that a red light is due to a comparatively long undulation; while a violet light, which always appears at the opposite end of the spectrum, is due to a short undulation. The white or diffused light of day results from the coexistence of undulations of all possible lengths.

319. The *color of a body* is due to its power of neutralizing undulations of certain lengths, or allowing them to pass through, and of reflecting or turning back others; and its color will be the resultant of the coexistence or union of the reflected undulations.

The body appears white when it reflects all the different vibrations in the proportion in which they are in the spectrum; and it appears black when it reflects such small quantities of vibratory motion as not to affect the eye. Thus, if a piece of red paper is held in the red part of the spectrum, it appears a brighter red; but, if held in the violet, it appears nearly black.

320. The *spectrum* consists of the seven primary colors of light, as well as the actinic rays, resulting from the decomposition of a ray of sunlight when refracted in passing through a prism. No body, unless self-luminous, can appear of a color which does not exist in the light incident upon it.

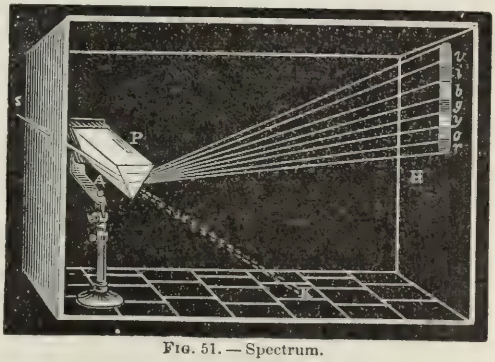


FIG. 51. — Spectrum.

The molecular structure of a body determines what rays of light it will absorb or pass through, and what it will reflect; hence any change in its molecular structure may cause it to appear of a different color, as in case of chemical changes.

321. Bodies which emit light are called *luminous*, as the sun.

322. Bodies which transmit light, and through which objects can be distinguished, are called *transparent*, as water, glass, etc.

323. Bodies which transmit light, but not so as to permit objects to be seen through them, are called *translucent*, as ground glass.

324. Bodies which absorb or reflect all the rays of light, or transmit so few rays that the eye does not perceive them, are called *opaque*, as wood, metals, etc.

All opaque bodies are more or less translucent when divided into thin leaves, for the less the quantity of material the greater the motion propagated in it by the vibratory motion in the air.

325. A *luminous ray* is the direction of the line in which light is propagated.

326. A *luminous pencil* is a collection of rays from the same source; and it is parallel when composed of parallel rays, *divergent* when the rays separate as they progress, and *convergent* when they tend toward one point.

327. A *medium* is any substance in which light can be propagated.

A *homogeneous* medium is one which has the same composition and density in every part, and in every such medium light is propagated in straight lines.

328. Light changes its direction when it meets an opaque or an impassable object, or when it passes from one medium to another. In the former case the light-rays are *reflected*, and in the latter they are *refracted*.

329. When light from a luminous body meets an opaque body, the space behind it is not illuminated, and this unlighted space is greater or less as the comparative size of the luminous body is greater or less. The space from which the light is wholly shut off is called the *umbra* or shadow; and the space which receives light from some portion of the luminous body, but not from the whole of it, is called the *penumbra*.

VELOCITY OF LIGHT.

330. Experiments by M. Foucault on the velocity of light established the fact that its velocity is greater in air than water; and proved the correctness of the undulatory theory, that the velocity must be less in a highly refracting medium, for more force is necessary to propagate the same kind of motion in a dense than a rare medium.

M. Cornu has recently investigated the velocity of light by the mechanical method of M. Fizeau, and obtained a result almost identical with that of M. Foucault, and also closely agreeing with the result obtained from the astronomical observations of the transit of Venus in 1874. The velocity in air is found to be about 186,000 miles per second.

331. The laws of the intensity of light are the same as those of heat:—

I. The *intensity of light on a unit of surface at any given distance is inversely as the square of its distance from the source of light.* (See Fig. 46, under HEAT, for illustration, the distance S A being equal to 1 unit, and the distance S B equal to 2 units.)

II. *The intensity of illumination which is received obliquely is proportional to the cosine* * *of the angle which the luminous rays make with the normal or perpendicular to the illuminated surface.*

When rays of light strike a polished surface at an angle which does not allow their passage through the substance, they are reflected in accordance with the laws governing the reflection of heat. (See Par. 265.)

332. A surface sufficiently polished to reflect the whole or the greater portion of the incident rays of light is called a *mirror*. Mirrors may be *plane*, *concave*, *convex*, or of any regular geometrical shape. The representation of any object, resulting from the reflection of rays of light, is known in optics as the *image*. Plane-glass mirrors are made by coating the back of glass plate with amalgam of quicksilver and some other metal, and the images are produced by the reflection of the rays of light from the metallic surface.

A portion of the incident light is regularly reflected from the anterior or front surface, producing a very faint image, while another portion irregularly reflected renders the surface of the glass itself visible. But the greater portion passes into the glass and is reflected from the metallic surface at the back, and produces a strong image. The first image mentioned will be the thickness of the glass in front of the other, but in good mirrors the latter will be so brilliant as to render the first invisible. If the surface of the glass could be so highly polished as to reflect all the rays of incident light, the glass itself would not be seen; but there would appear to be an opening in the wall, if the glass were placed perpendicularly against it.

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* See Geometry for explanation of "cosine."

333. We always seem to see an object in the direction from which the rays come; hence a mirror, changing by reflection the direction of the rays proceeding from an object, also changes the apparent position of the object.

The angle of incidence and reflection being equal, any *image* in a plane mirror will be as far *behind* the mirror as the *object* is *in front*, and in an inverted position, because the light from the parts of the object which are farthest from the glass make a greater angle with the plane of the glass, and a less angle with its normal.

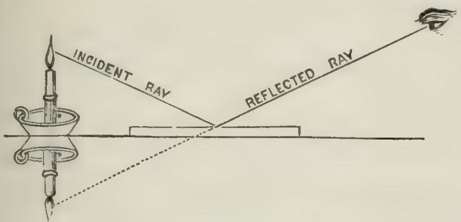

Fig. 52. — Inverted Image in a Plane Mirror.

Fig. 52, in which the candle seems inverted, well represents this principle. The principle is the same which causes trees to seem inverted in a pond, and which makes our image in the mirror seem to approach us as we move toward the mirror.

The greater the angle of incidence, the greater the amount of light reflected; and the less that angle — that is, the nearer a perpendicular the rays of light strike a reflecting surface — the less the amount reflected; hence a better image is obtained of distant than near objects, when reflected on the surface of water. (See Fig. 53.)

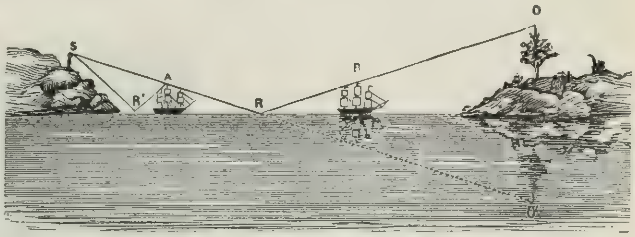

Fig. 53. — Trees, etc., inverted in Water.

334. When an object is placed between two parallel plane mirrors, each will produce an image, and each image will act as an object to produce other images; and if the vibrations were not successively weakened by each reflection, the number of images would be infinite. The number of images, then, formed by an object placed between two mirrors will depend upon the angle formed by the mirrors, and will be one less than the quotient of 360 by that angle.

Thus, if the mirrors are at right angles, or 90°, three images will be produced; if at 45°, seven images; at 30°, eleven images, etc. It is upon this principle that the kaleidoscope is constructed.

335. The reason for the long line of sparkling light which the oblique rays of the sun or moon produce upon the slightly agitated surface of a large body of water is, that the vibratory motion of the water brings some portion of each wave into position to send its reflected ray of light to the eye of the observer.

336. In plane mirrors the *image* has no real existence, for the rays do not come from the other side of the mirror, as they appear to do; hence this appearance is called the *virtual* image, to distinguish it from an image formed in front of some mirrors at a point called the focus, where the rays of reflected light converge. This latter image can be received on a screen, and is for this reason called a *real* image.

337. A portion of the incident light upon any transparent substance is absorbed, and a portion is irregularly reflected by irregularities of the surface, and is called *scattered* light. It is scattered light which makes bodies visible. It is this diffused light in the upper layers of the atmosphere, after sunset and before sunrise, which produces the appearance called *twilight*.

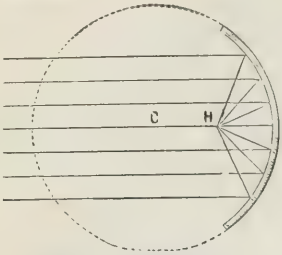

Fig. 54. — Principal Focus.

338. Mirrors are *convex* or *concave*, according as the reflection of light takes place from the *external* or *internal* surface of a hollow spherical segment,* such as is used for the reflectors of lanterns and calcium lights.

339. In a *concave* mirror the reflected rays converge to a point half-way between the surface of the mirror and the centre of its curvature, as in Fig. 54.

This point is called the *principal* or *real focus* of the mirror, and its distance from the centre of the mirror is called its *principal focal distance*.

All rays parallel to the axis meet in this point; but if a light be placed at this focus, the rays will be reflected from the mirror in parallel lines, as appears in Fig. 54.

Concave mirrors are sometimes called *burning-mirrors*, since, if large, they reflect sufficient heat to the focus to set on fire combustible material. Archimedes is said to have employed burning-mirrors to destroy the navy of the Roman consul Marcellus, at Syracuse, in the year 213 B.C.

If a luminous body be placed at the centre of curvature of a concave mirror, the rays will be reflected directly back to the point of emission, because they all strike the mirror perpendicularly.

340. When the luminous body is placed beyond the centre of curvature, the rays will converge to a point between the principal focus and the centre. (See Fig. 55.)

When the light is placed between the centre C and the focus F, the rays will converge to a point beyond the centre, and farther from it as the light is placed nearer the focus.

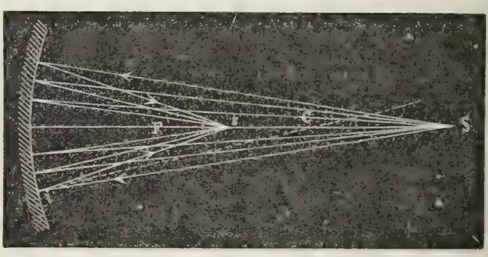

Fig. 55. — Light between Focus and Centre of Curvature.

341. Whenever the reflected rays meet in a point other than the focus, F, the point of meeting is called the *conjugate focus ;* because, if the light were placed there, the rays would meet in the point previously occupied by the light.

342. If the light be placed between the principal focus, F, and the mirror, the rays will diverge from the mirror, and, as in the plane mirror, an image will appear behind the mirror, erect, and larger than the object. This will be a *virtual* image in a *virtual* focus.

343. When an object is between the principal focus and the centre of curvature, the image will be *real*, *inverted*, and *larger than the object.*

344. The *principal* and *conjugate foci* are always on the same side of the mirror as the object, while the *virtual* focus is always on the other side of the mirror.

345. The *principal* focus has a constant position, while the *conjugate* and *virtual* foci vary in position.

346. When the object is beyond the centre of curvature C, the image will be *real*,

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* See Geometry.

inverted, and smaller than the object. In all these cases, if the aperture of the mirror exceeds 10 degrees, the incident rays are modified in their reflection.

In past ages, advantage was taken of the superstitious and ignorant by using the concave mirror to enlarge objects and make them appear in the air in a distorted manner, as their images were formed at a focus which came in line with the smoke rising from burning incense.

347. *Convex* mirrors, like plane mirrors, have only virtual foci, and consequently virtual images, which are always *erect, behind the mirror*, and *smaller than the object.*

348. The *principal virtual focus* in a convex mirror is in the axis behind the mirror, and half-way from its surface to the centre of curvature.

349. If concave or convex mirrors have an aperture of more than 10 degrees, the rays reflected near the edges of the aperture meet the axis nearer the mirror than the others do, hence interfere somewhat with the formation of a perfect image, and this lack of precision is called *spherical aberration.*

REFRACTION OF LIGHT.

350. The laws of refraction are the same for light as for heat, and are as follows: —

I. *Whatever the obliquity of the incident ray, the ratio which the sine* of the incident angle bears to the sine of the angle of refraction is constant for the same two media, but varies with different media.*

II. *The incident and the refracted ray are in the same plane, which is perpendicular to the surface separating the two media.*

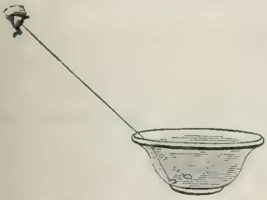

FIG. 56 — Coin in Basin.

351. The quotient resulting from the division of the sine of the angle of incidence by the sine of the angle of refraction is called the *index of refraction.*

From air to water it is $\frac{4}{3}$; from water to air it would, of course, be the reverse of $\frac{4}{3}$, or $\frac{3}{4}$. From air to glass it is $\frac{3}{2}$.

352. The effect of refraction in the immersion of bodies in a more highly refracting medium than air, is to make them appear nearer the surface than they really are; hence a stick appears bent at the water's surface, and the effect is the reverse when passing from the denser to the rarer medium.

On account of refraction a coin in a basin, just hidden by its edge, may be brought into view when water is poured into the basin.

The sun and moon are seen, when wholly below the horizon, on account of the increased density of lower layers of the air.

For the same reason, the *mirage* of the desert occurs. In this case, however, one reflection takes place in connection with many refractions.

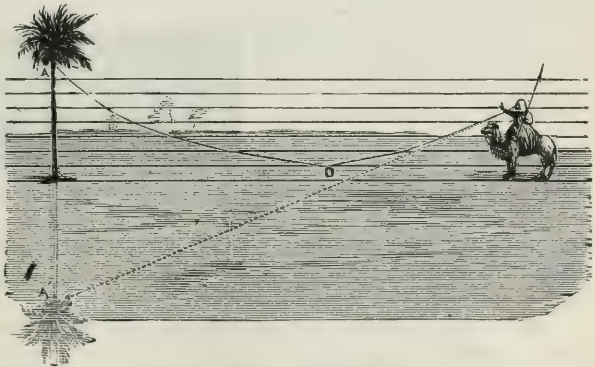

FIG. 57. — Mirage.

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* For "sine," see explanation in Geometry.

353. A glass which has two plane surfaces not parallel is called a *prism;* but the ordinary prism is triangular. It is used for producing the spectrum.

354. *Lenses* are transparent substances which, from the curvature of their surfaces, cause rays of light passing through them to diverge or converge. Lenses are commonly made either of crown-glass or flint-glass.

355. The combination of spherical surfaces results in six kinds of lenses, represented in Fig. 58.

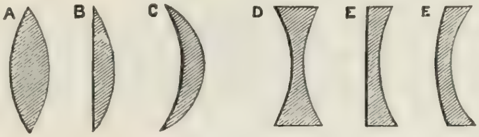


Fig. 58.—Lenses.

A *is a double convex;* B, *a plano-convex;* C, *a converging concavo-convex;* D, *a double concave;* E, *a plano-concave; and* F, *a diverging concavo-convex.*

The first three lenses, being thicker at the centre than at the borders, cause the refracted rays to converge; the others are diverging, because thinner in the centre.

356. The *axis* of a lens is a straight line passing through the centre perpendicular to the surface. Parallel rays of light, incident to a double-convex lens, are converged to a focus varying as the curvature of its surface.

357. The distance from the middle of the lens to its principal focus is the *focal distance.* This, in the *single-convex* lens, is equal to the diameter of the sphere of corresponding curvature, and in the *double-convex* lens is equal to the radius of that sphere.

358. Rays from a light, in its principal focus, will pass through and emerge parallel to the axis. In general, *convex lenses* produce images like those of *concave mirrors,* and in the same manner.

359. The properties of *concave* lenses are entirely different from *convex* lenses, and they produce images in their foci in the same way and of like kind as *convex mirrors.*

360. Convex lenses, as ordinarily used, are called magnifying glasses, or *microscopes.* This magnifying power consists simply in bringing a large number of rays to a focus; hence objects at a distance can be seen more plainly through such lenses because a larger number of rays enter the pupil of the eye.

361. Two of these lenses are used, therefore, in constructing a *refracting telescope;* the object-glass collecting the rays from the object, and the eye-glass magnifying the image of the object-glass.

362. A terrestrial telescope consists of four lenses, in order to produce the object in an erect position, as a single-convex lens inverts the image.

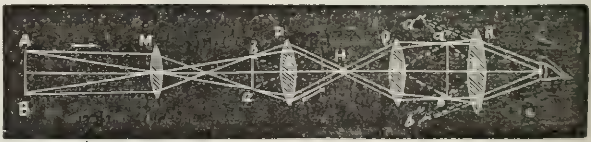


Fig. 59.—Terrestrial Telescope.

363. The *camera-obscura* used for photographic purposes consists of a pair of achromatic double-convex lenses, set in a brass mounting into a box of two parts, one sliding within the other. The total length of the box is adjusted to the focal distance of the lens. The images are received upon a square piece of ground glass in the back of the box.

364. The *compound microscope* also consists of two convex lenses so arranged as to view an enlarged image of the object.

365. The *double-concave lens* causes the image of an object to seem smaller, but erect.

This lens is used as the eye-glass of common opera-glasses, since it causes the converging rays of the double-convex object-glass to diverge and enter the eye parallel.

366. The *eye* is a mechanical arrangement similar to the simple *camera-obscura*, and consists of a double-convex lens in one side of a spherical chamber, through which the rays of light pass and form an inverted image upon the back wall of the chamber, called the *retina*.

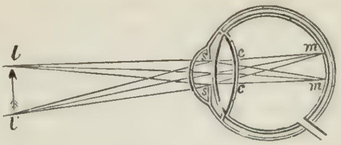


Fig. 60. — The Eye.

When the *lens* or *crystalline humor* of the eye has not the proper shape to bring the rays from an object to a focus upon the retina, artificial lenses called glasses or spectacles are used to correct the defect.

367. *Concave* lenses *remedy the defect* of *shortsightedness*, which is occasioned by too great convexity of the lens of the eye.

368. *Convex* lenses correct the defects of vision occasioned by the *flattening of the lens of the eye*, which generally takes place in old age.

369. The *reflecting telescope* consists of a concave mirror, called a *speculum*, at the closed end of a long tube, and a small convex lens for an eye-glass to magnify the image of the mirror. In this telescope the open end is presented to the object to be viewed.

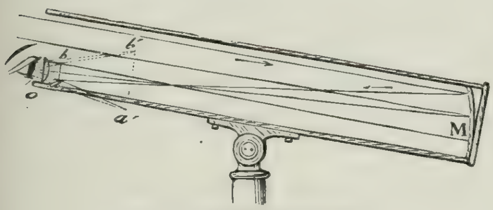


Fig. 61. — Reflecting Telescope.

Lord Rosse's telescope at Parsonstown, Ireland, is of this character; and it is said that with it objects one hundred yards in extent can be distinctly discerned on the moon, two hundred and forty thousand miles distant.

370. The *magic lantern* is an arrangement of magnifying lenses for the purpose of exhibiting pictures painted on glass, on a large scale, in transparent colors.

The combinations known as dissolving views are produced by the use of two such lanterns in throwing pictures of the same magnitude upon the same screen, and gradually closing the aperture of one lantern and opening that of the other.

The solar microscope is constructed on the same principle as the magic lantern, only the light of the sun, instead of a lamp, illuminates the objects viewed.

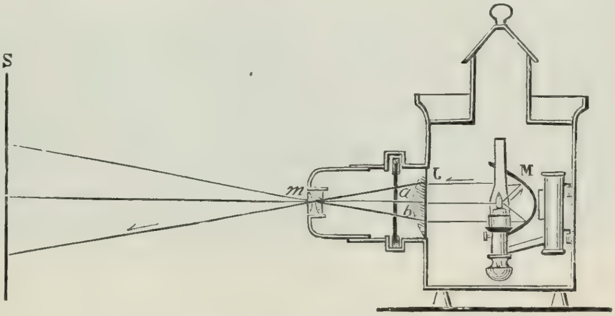


Fig. 62. — Magic Lantern.

371. It has been already remarked that the spectrum is produced by passing a ray of white or sun light through a prism. This is occasioned by the different degrees of refrangibility of the rays of light which produce the various colors.

The *relative* position of the seven colors of the spectrum *is always the same*, and *in the order of their respective degrees of refrangibility*.

Beginning with *red*, which is least refracted, their order is as follows: viz., red, orange, yellow, green, blue, indigo, violet.

372. Experiment has established the fact that the *degree of refrangibility* depends upon

the *length*, and consequently upon the number in a given time, of the vibrations of the different rays; *hence the length of the undulation determines the color of light.* The *longest* waves are *least refracted;* hence they produce the *red* of the spectrum, and the *shortest* produce *violet.* The length of a wave of red light is about $\frac{1}{38000}$ of an inch, and of violet $\frac{1}{60000}$ of an inch. As all these different waves are transmitted in the same length of time, the rapidity of their vibrations will increase from red to violet; for the shorter the waves the more rapidly must they vibrate in order to advance with the same velocity.

373. The colors of the spectrum cannot be further analyzed or separated by refraction, showing that these colors are simple, and each ray forming them has a different index of refraction; but the eye cannot detect the numerous differences in shade of the same color, and can only guess where each of the seven colors begins in the spectrum.

374. The *spherical aberration* of lenses, which arises from the difference in the distance of the object from the different parts of the surface of the lens, may be corrected by a combination of lenses of different refractive powers.

375. White light can be compounded of any two tints or colors which are *complementary.* The colors of the solar spectrum which are complementary may be determined by taking any measure equal to half the length of the spectrum, and noticing the colors upon which its ends rest as it is moved from color to color. Red and greenish-yellow are complementary, as are orange and blue, yellow and indigo-blue, greenish-yellow and violet. Two colors placed side by side modify each other, and they will look best when they are complementary.

376. The *light* of the yellow part of the spectrum has the greatest intensity, and that of the violet the least.

377. Seebeck and Melloni found that the *heating effect* in the spectrum varies with the nature of the prism: with a prism of water, the greatest heat was in the yellow; with one of alcohol, it was in the orange-yellow; and with one of crown-glass, it was in the middle of the red.

378. Wollaston found that *chemical action*, while most active in the violet, continued beyond the violet, showing that there are rays of such rapid vibration that the eye cannot perceive them. They are called *actinic* rays.

379. It also appeared that heat-rays were outside of the red rays, indicating not only the refraction of heat, but that the greater the intensity of the heat motion the greater also was the intensity of light; as the heat became transformed into light, the temperature was correspondingly reduced (Fig. 63).

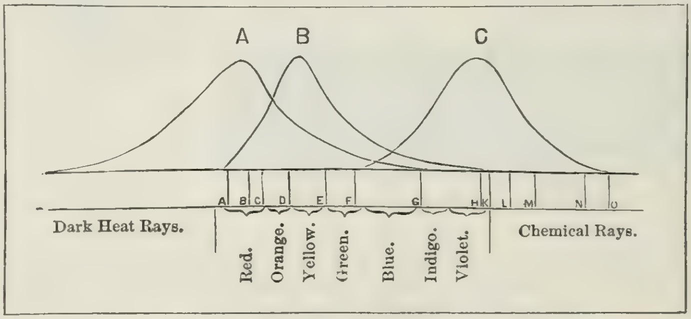


FIG. 63. — Relative Intensities of Heat, Light, and Actinic Rays.

A representing the curve of thermal or heat intensity.
B " " " luminous "
C " " " actinic or chemical "

380. A *blue* glass obstructs nearly all the light and heat of the solar ray, but allows the actinic rays to pass freely; while a *yellow* glass allows the passage of light and heat, but obstructs the actinic rays.

381. *Light*, then, seems to be only *visible heat.* Beginning, therefore, with mechanical action which results in sound, we find that the different phenomena, of which we can take note by our senses, are simply different forms of motion, or different lengths of undulations more or less rapid.

We shall find that electricity is not an exception.

382. The *rainbow* is the result of the refraction of the sun's rays in drops of water as they are falling, producing decomposition; and the action consists in two refractions and one reflection in the drop, as represented in Fig. 64.

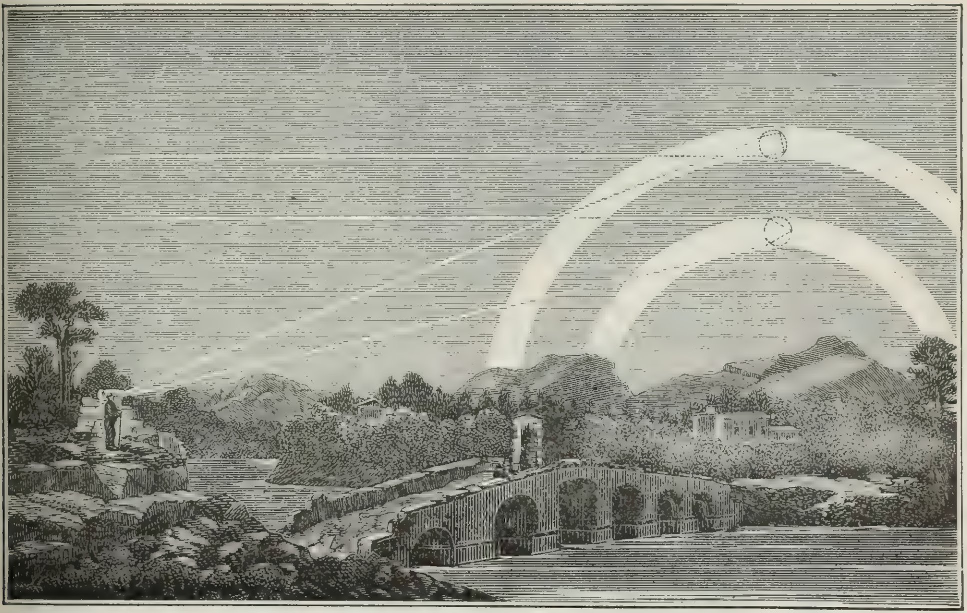


Fig. 64. — Refraction in Drops to produce Rainbows.

It is seen only when the rain is falling in an opposite part of the heavens from the sun, and when the sun is less than 42 degrees above the horizon.

When a *secondary* bow is seen in company with the *primary*, it is produced by two reflections at right angles within the drops, and a refraction on entering and leaving; hence this bow is fainter than the other, because at each change of direction some of the rays are absorbed. (See Fig. 64.)

The secondary bow cannot be seen when the sun is more than 54° above the horizon; and in this bow the violet will be the highest color, and the others in regular order beneath, on account of the second reflection; while in the primary bow the red will be at the top.

383. It was early observed by Fraünhofer that the dark lines which appear in the spectrum, while the same for the sun and planets, sometimes varied in the spectrum of the

stars. This led Bunsen and Kirchoff to systematic analysis by means of the spectrum, and to the invention of the spectroscope to aid in this analysis.

384. The *spectroscope* consists, as shown in Fig. 65, of a prism, P, fixed on an upright stand, and three tubes also fixed to the stand, with one end of each toward the prism.

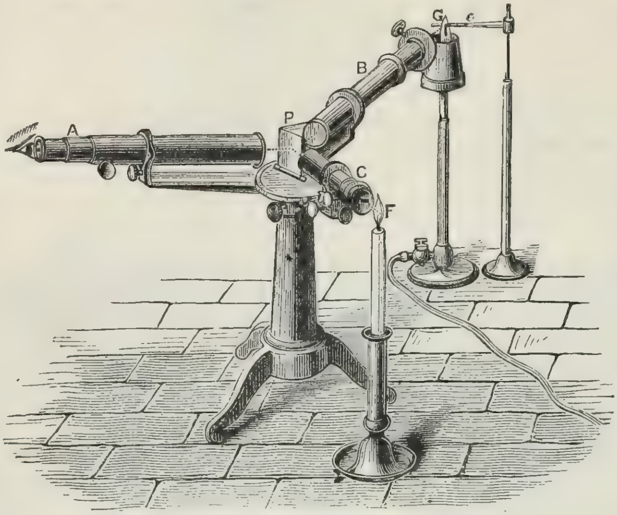


Fig. 65. — Spectroscope.

The substance whose spectrum is to be examined is vaporized in a flame at G; the light passes through a series of lenses in the tube B, is refracted by the prism, and forms an image of the spectrum on the object-glass of the telescope, A, where it may be examined through the telescope.

In the tube B is a graduated scale whose image may be thrown on the prism, thus aiding in fixing the relative position of the lines of the spectrum.

Many new metals have been discovered by the spectrum analysis.

The incandescent vapor of *potassium* gives a spectrum crossed by one red and one violet line; *sodium* gives a yellow line; *lithium*, a red line and an orange line; *calcium*, green and orange lines; *caesium*, two blue lines; and *rubidium*, two red and two violet lines.

The ease and delicacy of spectrum analysis render it a valuable aid in the quantitative analysis of alkalies and earths.

The presence of any of the *elements* in a substance can be at once determined by this means. The purity of human blood may be tested, and adulterations in wine, beer, and other liquids may be detected.

385. *Diffraction* is a modification which light undergoes when it passes the edge of a body, or through a small aperture, and the rays appear bent; and, instead of a sharply defined image, colored fringes appear around the shadow.

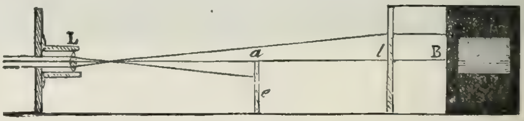


Fig. 66. — Diffraction.

This is the result of the interference of waves of light.

DOUBLE REFRACTION AND POLARIZATION.

386. *Double refraction* is a power which certain transparent substances possess, by their molecular arrangement, of dividing a ray of light into two rays by causing two refractions instead of one.

Crystals of "Iceland spar," mica, topaz, gypsum, ice, tourmaline, etc., produce double refraction.

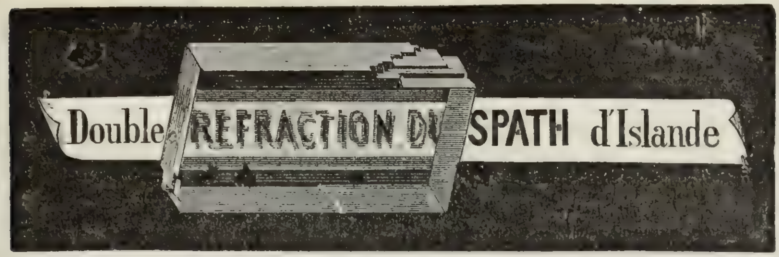


FIG. 67. — Double Refraction by Iceland Spar.

All substances which produce double refraction have one or more directions in which an object would appear single.

That double refraction is caused by the molecular arrangement of the medium through which light passes is evident from the fact that water does not produce it, while ice does.

387. Light is called *polarized* when, on being reflected or refracted by a surface or medium, a second reflection or refraction depends on the position of a second surface or medium.

The polarizing angle, or the angle which the incident ray must make with the perpendicular to the first reflecting surface in order to be polarized, depends upon the substance.

For water it is 52° 45′, for quartz 57° 32′, and for diamond 68°.

The undulations of light ordinarily take place in planes perpendicular to the direction in which they are propagated, but in case of polarized light they take place in planes parallel to this direction.

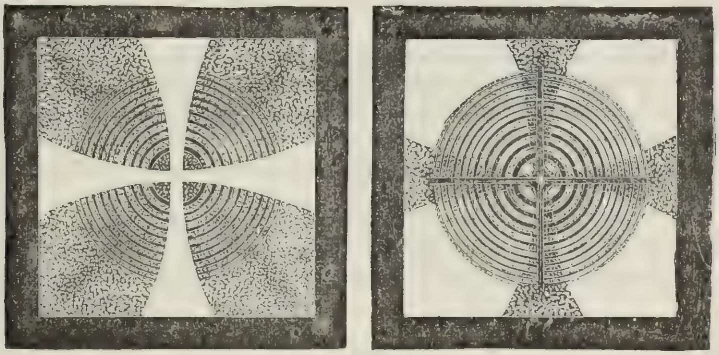


FIG. 68. — Polarized Light.

At certain angles the undulations, thus changed from their usual direction, are transmitted by the second reflecting or refracting surface to the eye; but at an angle of 90° they are stopped, and the object can no longer be seen.

Many practical results have followed the discovery of this principle.

By this means it can be determined whether light proceeds from a solid, liquid, or gaseous body, and whether the body from which it comes is self-luminous, or only reflects the light; also whether a crystallized body has been adulterated with foreign substances, as in case of sugars.

SOURCES OF LIGHT.

388. The *sources of light* are the sun, the stars, heat, chemical combination, phosphorescence, and electricity.

All these, except the last two, have already been discussed in some part of this work.

389. *Phosphorescence* is the property, that a large number of substances possess, of emitting light under certain conditions: —

I. Spontaneous phosphorescence in certain vegetables and animals.

II. Phosphorescence by elevation of temperature.

This is seen in certain species of diamonds, and in chlorophane, — a variety of fluor spar.

III. Phosphorescence by mechanical action, as when two quartz-crystals are rubbed together in the dark, or a lump of sugar is broken.

IV. Phosphorescence, by exposure to the sun.

A large number of substances in darkness after such exposure present this appearance, as silk, cane-sugar, milk, sugar, amber, teeth, etc.

In all these cases the phenomenon is the result of certain changes in chemical structure or molecular arrangement, releasing absorbed or transformed light and heat.

ELECTRICITY.

390. The term *ELECTRICITY* seems to date from about 600 B.C., when Thales discovered that *electron* (the Greek word for amber), after rubbing, attracted light-particles. Of course the ancients witnessed the manifestations of electricity in various ways, but did not know that they were due to the same force; and in fact, until about A. D. 1700, electricity had no existence as a science.

It is only within the present generation that the true theory regarding it has obtained; and even to-day many hold to the theories of Franklin or Du Fay, that electricity is an imponderable fluid or fluids existing in all matter in a latent state, and that it can be aroused by friction.

This is in keeping with the exploded theories that light and heat were substances, and, we believe, has no better foundation.

We do not understand how, since the theory of universal gravitation was established, any man of science can believe in an imponderable fluid, — a substance without weight. It is contrary to all the experience of mankind, and it seems inconceivable in the light of this century.

The fact, however, that a body through which an electric undulation or vibration is passing weighs no more then than at any other time, necessitates the theory of a fluid or fluids without *weight*, if we are to hold the fluid theory at all.

In discussing this subject, it is more convenient to use the terms to which people have become accustomed on the fluid bases; but it must be distinctly understood that, when the term *electricity* is used herein, *it* is considered as representing a *mode of motion* or *force in matter*, whose molecules it arranges in a certain direction, depending upon its line of action.

391. This mode of motion or force called *electricity* is developed by friction, chemical action, and mechanical action.

The peculiar manifestation of this force in a particular instance depends upon the molecular structure of the body or bodies in and by which the force is generated and propagated, as well as upon the method of producing such motion.

If the force is generated by friction, as by rubbing a glass tube with a substance whose fibres are elastic, and separated by air in their interstices (as wool, silk, hair, dry paper, rubber, etc.) so as to present an uneven surface, the particular phenomenon is the apparent alternate attraction and repulsion of light-particles, like shreds of cotton, small pieces of paper, pith-balls, etc.

We say apparent attraction, because there may be no actual attraction, but simply the result of action and reaction resulting from motion; or it may be the result of alternate condensation and rarefaction of the air resulting in convection.

In any case it is the result of motion in the form of friction.

392. REACTION is a consequent of motion, and two elastic bodies cannot be brought in contact by any force, however slight, without reaction; hence, when two such bodies whose molecules are so arranged as not to conduct motion readily are rubbed together, motion must necessarily be produced in opposite directions.

When friction is produced between any two substances having different characteristics, as glass and rubber, they act in opposite directions; and a pith-ball after having been repelled by the one will be drawn toward the other, or, if it be attracted by the one, it will be repelled by the other. This phenomenon is often noticed in factories, where the endless bands, by friction on the wheels, cause cotton fibres to fly about by alternate action and reaction (or attraction and repulsion, if you please), and sometimes produce sparks several feet in length; so that steam must be admitted, to absorb the electricity, or act as a conductor for it to pass off.

These phenomena have received from the fluid theorists the designations of *positive* and *negative electricity*, or *vitreous* and *resinous*, the latter because glass and resin, when rubbed, act oppositely.

We shall use the terms *positive* and *negative* to designate the two modes of electrical force. Neither can be produced without the other, and both must act at the same time, as action and reaction.

When a pith-ball is excited by positive electricity, as above mentioned, the kind of electrical action in another body can be determined by its attraction or repulsion of the ball; the attraction indicating *negative* and the repulsion *positive* electricity.

When the motion in two equal bodies coming in contact is equal, the motion of each in its respective direction ceases. So if two bodies brought in contact in an electrified state, as paper and glass, have only the same amount and same kinds of motion as surrounding objects, there will be no repulsion. It is *inequality* of *motion* in the molecules of different bodies which produces change of place of the bodies themselves.

393. *Motion is inherent in matter*, and a particular phenomenon is only the presentation of a peculiar mode of that motion or force; the *mode* depending upon the arrangement of the molecules of the substance.

394. Bodies in which this mode of motion called electricity is easily produced are called *electrics*, and those in which it is produced with difficulty are called *non-electrics*. Generally the *electrics* are *non-conductors*, and the *non-electrics* are *conductors*.

395. The *metals* generally are good *conductors*, as are charcoal, water, snow, and animals.

396. The *non-conductors* are glass, silk, wool, hair, feathers, leather, amber, shellac, the resins, air, gases generally, etc. These are also the best *insulators*, because they do not readily conduct electricity from a body in which it has been produced.

397. *Insulation* of electrified bodies is the cutting off communication with bodies which are good conductors.

398. Electricity always moves in the best conductor, or it naturally is propagated in that medium which offers the least resistance to its passage to the earth, which is a natural reser-

voir. When a generator of electricity is connected by a good conductor with the earth, the electricity passes as rapidly as it is produced, and no appearance of electricity will be observed. The tendency of all bodies to assume the same conditions, and the inability of some bodies to acquire those conditions, cause all the phenomena of nature.

399. The *velocity* of electricity varies with the medium from 18,500 to 288,000 miles per second. The passage of a fluid at such a rate is inconceivable; but the propagation of motion in a fluid with enormous velocity has been fully established.

400. There are various machines for producing electricity by friction, but, as they are of little use except for experimental purposes, we will only say that the principle of all is to produce a more or less rapid friction upon a glass plate or cylinder while it is insulated.

The electricity thus produced may be conducted by a brass knob and chain into a glass vessel coated inside and out with tin-foil; or it may be passed into a person standing upon an insulated stool, that is, a stool with glass legs. It is claimed to act as a medicinal cure in certain cases, but we would not vouch for its truth.

Every person has undoubtedly noticed the snapping sound when stroking a cat, and frequently when combing their own hair.

It is simply the passage of electricity from the hair to a good conducting medium.

If the fingers at such times be presented with the ends toward the head, the hairs will stand erect, because of the tendency to equality of motion.

Electricity passes from points to the air more readily than from flat surfaces, as the same quantity will be distributed over less space and will exert greater force at one point; and, a current of air having been produced, the motion in the metal will be more easily communicated and will be constant and silent. The same principle is illustrated by the difference in the passage of heat from the body when the air is in rapid motion than when its motion is slight.

401. The air conducts very slowly, but conveys rapidly.

When electricity accumulates because the generation of the force is more rapid than can be transmitted by the air, the point is soon reached when the intensity of motion in the generator exceeds the tension of the atmosphere, and *the layers of air yield to the pressure at a point which is the shortest distance from the generator to a good conductor.* The result of this break is a crackling noise, and *the spark* following this rapid motion *is the combustion of minute particles of matter* by the resultant heat.

The color of the spark, therefore, will vary with the medium.

402. The tendency of surrounding insulated bodies to assume the same state of electrical action as a body in which such motion is generated, when they are separated by non-conducting substances, is matter of fact, and is the result of very gradual conduction by the non-conducting medium, and shows that all substances will transmit this force, though some do so very slowly.

Insulated bodies thus electrified are said to be electrified by *induction.*

403. Electricity is developed also by the escape of steam from an orifice, and is the product of the vibrations resulting from the striking of small particles of water against the sides of the orifice.

ATMOSPHERIC ELECTRICITY.

404. *The electricity in the atmosphere is due to several causes*, including the evaporation of water from the earth; the chemical changes constantly taking place in the growth of trees and plants, and in changes in the rocks and soil; the condensation of vapors in the atmosphere; and the friction of the molecules of air of different densities.

The greatest amount of electricity in the atmosphere will be found in the upper regions, because, as the air becomes rarefied, it offers less opposition to this peculiar mode of motion.

405. The *aurora* is probably the result of friction of the molecules of air in rapid motion at great elevations, where the air is comparatively free from watery vapors on account of its condensation by the reduction of temperature.

This would of course be greater in the polar regions, where there is less radiant heat from the earth.

The varying colors are undoubtedly due to the difference in elevation, as we know that the color of the electric spark changes with the density of the air and in different mediums.

The more rarefied the air, the more nearly the color approaches a purple, the vibrations increasing in number as the rarity of the air increases.

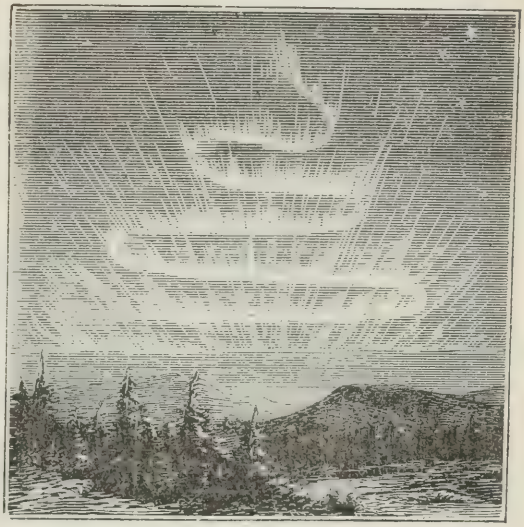


Fig. 69. — Aurora.

The silent passage of electricity from the air to a good conducting medium is witnessed in the luminous appearance called "St.

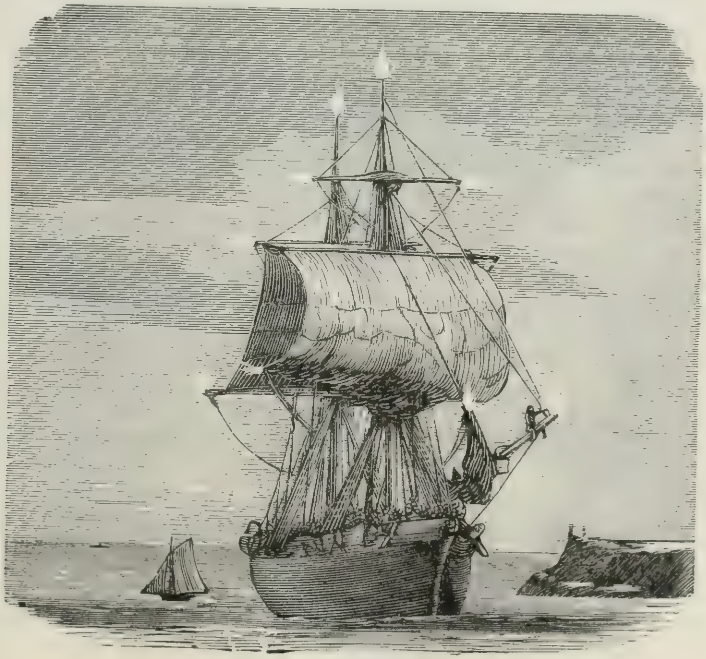


Fig. 70. — "St. Elmo's Fire."

Elmo's Fire," which is often observed at night on the tops of masts, on the tips of horses' ears, and pointed elevated conductors. During thunder-storms at sea this phenomenon is seen on various parts of the vessel, sometimes appearing like tongues of flame.

LIGHTNING.

406. *Lightning* is only the sparks produced by the resultant heat and light accompanying the passage of electricity from cloud to cloud or to the earth.

Thunder is the sound produced by the sudden breaking asunder and reuniting of the layers of air.

The appearance of lightning as a line of light depends upon the intensity of the motion, the direction taken, and the opposition offered by the air.

When the electrical force has been so increased by the condensation of vapor in a cloud that its intensity is greater than the tension of the layers of air, a breaking will occur, as in the case of wood fibres when too great a load has been placed upon the middle of a beam. The direction of this break in the air will depend upon the nearness of the cloud to the earth, and its nearness to another cloud in an opposite electrical state.

The air will offer less resistance, laterally or horizontally, from one cloud to another, than perpendicularly through the layers of increasing density, as a stick of wood will split more easily in the direction of its fibres than it will break across them. Hence, when the clouds are numerous, there is less danger from an electric discharge than when a single cloud positively electric passes near the earth. We frequently hear of buildings being struck by lightning when only a few flashes occurred in almost a clear sky.

As in case of electricity produced by an electrical machine, the greater the intensity of the electricity the greater the distance it will pass to a conductor; so inversely, in atmospheric electricity, the greater the distance it passes the greater will be its intensity and the more destructive its effect.

If the conductor to which it passes be very good, the electricity will be conveyed to the earth without doing harm; but if it be imperfect in any part, the obstruction may cause such a production of heat as to set the material on fire, or, if not combustible, it may be broken into fragments.

The nearer the conductor to the cloud the more likely it is to receive the electricity, because there is less atmospheric resistance to overcome.

407. Benjamin Franklin, in June, 1752, first proved lightning to be the result of electricity by charging a Leyden jar by means of a raised kite, with a key near the end of the string, which he held; and he invented the lightning-rod, to be used as a protection to buildings.

There is no doubt that properly insulated and erected copper rods are a real protection to isolated buildings.

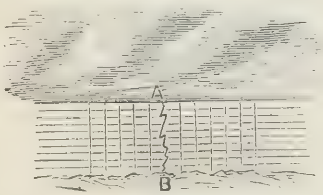


Fig. 71. — Lightning

In a city where wires pass over the tops of buildings in every direction, and so many points are presented for the silent passage of electricity, additional protection is not necessary.

The protection given by good conductors may be graphically represented by the following diagrams, of which Fig. 71 presents an electric field of cloud, under which the layers of air are in a state of tension which has been overcome by the concentration of electric force at one point, thus forcing a rupture, as represented by the broken line A B.

This result will follow when oppositely electrified surfaces are brought sufficiently near, or the intensity of electric force is increased beyond the resisting power of the air.

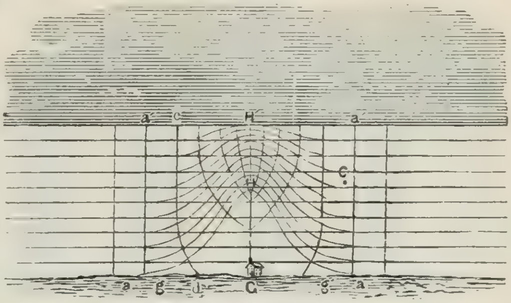


Fig. 72. — Lightning-Rod.

If upon a house (Fig. 72) a rod be erected, the electric field will be distorted, and whatever the relative distance of cloud and earth, or whatever the motion of the cloud, there will be a space, *g g′*, along which the layers of air will be more broken and more elevated and less dense, and within which the lines of force — perpendicular to the layers of air — will be longer than *a a′*, as *c d*; and there will be a circle, described about G as a centre, less subject to electric disturbance than the space outside of the circle; hence the area described by the circle will be protected by the rod G H.

At each point, from the ground to the top of the rod, the radius of the circle described at that point will diminish; therefore the rod protects a cone whose height is that of the rod, and whose base is the circle described by the radius G *a*.

The minimum radius must be equal to the height of the rod, since a cloud would not descend lower than the height of the highest building; therefore *the protected space would be a cone* whose *height* is the *length* of the *rod*, whose *base* is a *circle* having a *radius* equal to the *length* of the rod, and whose *side* is the *quadrant* of a *circle* described from a centre, *C*, equal in height to the height of the rod, with a radius equal to the length of the rod, C *a* and C H being the sides of the quadrant.

Prof. Wm. H. Preece, of England, the author of the rule just given, says that no record of an injury from lightning can be found to negative this as a practical rule.

ELECTRICITY PRODUCED BY CHEMICAL ACTION.

408. Galvani, a professor in the University of Bologna, Italy, in 1790, accidentally discovered that copper and iron in contact with the legs of a frog would cause them to contract; he attributed the action to a vital fluid in the nerves, which he called animal electricity, but it has since been known as *galvanism*.

Prof. Volta, of Pavia, soon proved that the animal had nothing to do with the phenomenon other than to indicate an action which takes place when dissimilar metals are brought in contact in a moistened state.

Volta's celebrated pile was the result of his experiments; and the galvanic battery, so called in honor of Galvani, produces a kind of motion, which, in honor of Volta, has been called *voltaic electricity*.

It is now known that this motion is due to chemical action; and batteries variously named have been constructed for the production of electricity since it has come into general use in telegraphy and otherwise.

409. The most noted batteries are Smee's, Daniell's, Grove's, and Bunsen's.

Grove's battery was long in use, but, the price of platinum rendering its construction costly, Bunsen substituted carbon for platinum. In all other respects it is like Grove's, but not so powerful.

410. *Grove's battery* consists of a porous cup containing a strip of platinum immersed in nitric acid, which is placed within a zinc cylinder filled with dilute sulphuric acid.

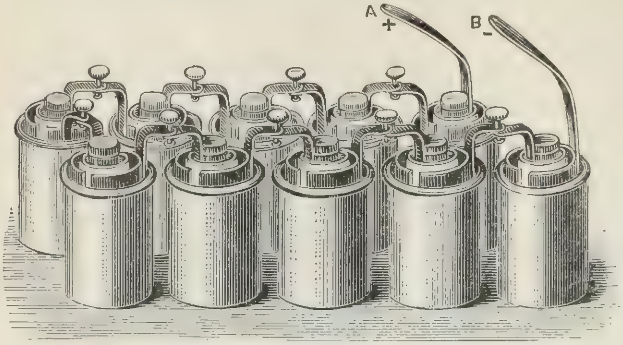


Fig. 73.—Grove's Battery.

The whole is set in a vessel of glass or earthenware; and, if more than one cup is used, the platinum of one cup is connected by a wire with the zinc of the next cup, and so on, the wire attached to the platinum extremity exhibiting positive electricity, and the wire attached to the zinc exhibiting negative electricity. The superiority of this battery consists not only in its power, but in the absorption of hydrogen evolved.

411. A *dry pile* consists of numerous circular pieces of copper and zinc paper pressed together in the same order, like Volta's pile, and fitted closely into a varnished glass tube. Bells have been kept ringing for years by the attraction and repulsion of a clapper suspended between two such piles.

412. The *intensity* of voltaic electricity depends upon the number of plates, while the quantity produced is directly proportional to the amount of chemical action that takes place; and, by increasing the amount of surface exposed to the action of the acids, the quantity is increased.

Electricity developed by a single galvanic circle is great in quantity, but weak in intensity, just as a gallon of water at 80° contains a greater quantity of heat than a quart at 100° Fahr.

413. Voltaic electricity differs from frictional electricity chiefly in its continuance of action, and because the chemical action producing it is continuous, while the friction is temporary.

Frictional electricity, however, on account of its great intensity, will pass some distance to a conducting substance; but a current of voltaic electricity, when resisted by a non-conducting substance, stops at once. The former acts principally on the surface of bodies, while the latter acts upon all parts of the conductor alike.

414. When a current of voltaic electricity is passed through a compound conducting substance, the tendency is to decompose it, or separate it into its parts. This process is called *electrolysis*.

415. The action which takes place in Grove's or Bunsen's galvanic battery is as follows: Connection having been established between the platinum and zinc plates, the action of the sulphuric acid upon the zinc results in the liberation of hydrogen, which, acting on the platinum or carbon with nitric acid, forms water and hyponitrous gas.

This gas is partly dissolved, but a portion appears as nitrous fumes, which are injurious to animal tissues; hence the use of these batteries, though most common, is not desirable and in time others will undoubtedly be constructed with all the advantages of these, and free from this objection.

416. The wires or plates at the ends of the circuit are called the *poles* of the battery; and the pole connected with the metal most easily acted upon by the acid always exhibits *negative* electricity, while the other produces *positive* electricity.

The term *electrode* is sometimes used instead of *pole*, and the positive pole is called the *anode* and the negative pole the *cathode;* but we will adhere to the term *pole*, because it is in most common use, and is the term universally used in connection with magnetism, which we shall consider hereafter.

THE ELECTRICAL STORE-BATTERY.

417. If any person one year ago had tried to contract for the delivery of electricity in cans, to be used at the option of the purchaser, he would have been treated as a fit subject for a lunatic asylum; but to-day the feasibility of such an undertaking is a settled fact.

The principle involved in the action of the apparatus known as the *secondary* or *condensing* or *store-battery of M. Faure* is that of the now generally accepted doctrine of the conservation and transmutation, or storing and changing, of energy or force.

A current of voltaic electricity is turned into static chemical force, which spontaneously returns into the state of action from which it was obtained.

Electrical motion is transformed into chemical affinity in a cell of the store-battery, and is given back by a yielding of the chemical adhesion.

The material agents employed in accomplishing this result are *lead* and *red-lead* or *minium.*

Red-lead is a mixture of equal parts of the protoxide and sesquioxide of the metal. It is formed by exposing pure lead to a heat of 700° Fahr. while a current of air passes over it. It does not unite with the strong mineral acids, and it gives off considerable oxygen when raised to a red heat, and is thus changed into the protoxide.

It thus has a tendency to a double action, — the taking-in of oxygen by the protoxide, and the giving-out of oxygen by the fully oxidized substance.

The battery of M. Faure consists of two plates of lead, which are coated with the red oxides of lead just described, covered with porous felt, and rolled into the form of spiral scrolls.

The two scrolls are placed side by side in a vessel of acidulated water, and constitute a passive voltaic couple.

A strip of the lead is left projecting from each of the scrolls to the outside of the enclosing case, to afford the means of completing a circuit connection with the poles of an ordinary galvanic battery; and, when thus connected, a chemical action begins, and a voltaic current is established through the spiral plates.

The red-lead upon the plate, in connection with the positive terminal or electrode of the battery, is then gradually more highly oxidized, so that its sub-oxidized ingredient is converted into a peroxide of the metal, while at the same time the fully oxidized element connected with the negative pole is reduced to the state of unoxidized metallic lead.

This action continues until all the red-lead has been fully oxidized upon the plate connected with the positive pole, and reduced to the metallic state upon the other.

The chemical change then ceases, because the battery is stored or completely charged.

The electricity is stored as a fixed oxidized compound upon the positively electrified plate; and, if the connection with the galvanic battery is then broken, the electricity remains stored in the cylinder.

If, now, the couple thus oxidized be closed up into a circuit of its own by bringing the two terminal leaden strips into metallic connection, the work of the galvanic battery will be reversed, and the red-lead upon the positive plate will be reduced to the metallic condition; while the negative plate returns to its former state, and voltaic electricity moves out continuously during this change.

After storage the battery will remain in that state until its own plates are connected, and meanwhile it may be transported to any distance.

This is a wonderful discovery, and will greatly influence the utilization of electricity.

418. *The phenomena presented by compound substances when decomposed by electricity* produce the strongest evidence that electricity, like heat, light, etc., is only a *mode* of *force*,

and that the peculiarity of different substances is the result of their molecular arrangement and movement.

Thus, we find this invariable rule of the elements of compound substances when separated by this force, — *that chlorine*, *iodine*, *oxygen*, and the *acids* are arranged at the *positive* pole, hence are *negative* in action; while *hydrogen*, the *oxides*, and the *alkalies* are at the *negative* pole, and, we conclude, are *positive* in action.

In this way it appears that every chemical compound consists of a positive and a negative element united by electrical attraction, which in chemistry we call chemical affinity.

By means of voltaic electricity, Sir Humphrey Davy decomposed earths and alkalies which had been previously considered simple substances; and thus he discovered a number of new metals.

419. This power of decomposition possessed by voltaic electricity is employed in the various processes of *electro-metallurgy*, as electroplating and electrotyping.

These processes, while differing in some of the details, are the same in principle, which consists in the decomposition of the requisite metallic solution by voltaic electricity, and the depositing of the pure metal, which always moves to the negative pole, upon any article which has been attached in the solution to that pole. The thickness of that coating depends upon the length of time the process is continued.

If, for instance, we pass voltaic electricity through a solution of copper sulphate, the solution will be broken up into copper and sulphuric acid, and any clean, bright, metallic substance, in connection with the negative pole of the battery and immersed in the solution, will receive a deposit of copper.

If we use nitrate of silver solution instead of copper sulphate, silver will be deposited on the metal immersed.

All kinds of silver-plated ware are thus treated. If a solution of gold were used, gold would be deposited. This is the precise method of *electroplating*. The usual arrangement is shown in Fig. 74.

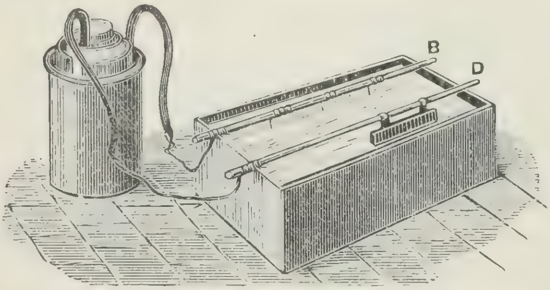


Fig. 74. — Electroplating.

420. Electrotyping *is the same after the mould has been prepared to receive the deposit.*

For engraved wood-blocks or type, wax moulds are commonly used; and they are prepared by pouring into a narrow flat pan a suitable mixture of wax, tallow, and Venice turpentine, which is allowed to harden somewhat, and is then carefully brushed over with very finely powdered graphite. While the mixture is still soft enough to receive an impression without breaking, the wood-block or type is pressed upon it and the mould is finished.

421. *Another strong proof of the molecular character of electricity* is its production by heating two dissimilar metallic bars which have been soldered together. Electricity thus produced acts like voltaic electricity, and is called *thermo-electricity*, because the motion or force called *heat* has been transformed into this motion or force called *electricity*.

422. *The work that can be performed* by the electricity generated in a galvanic battery is various in its nature and enormous in magnitude. It may take the form of *heat* by passing the electricity through a medium which offers some resistance to its passage, as through a fine platinum wire, the ends of which are joined to the battery wires, and the result is a

glow or *light*. If one of the battery wires be moved along the platinum wire toward the end to which the other battery wire is attached, the heat-motion becomes more intense as the length of platinum wire through which the electricity passes becomes less, until it finally (at about 3,000° Fahr.) overcomes the molecular cohesion of the platinum, and it is broken in pieces.

423. *Heat*, then, is produced by electricity propagated in solid conductors, and *is proportional in quantity and intensity to the chemical action in the battery;* and it may be produced as well in New York with the battery in Boston, if the wires are so long, as at the distance of a rod; hence it is well adapted to the firing of fuses in mines, or discharging guns simultaneously, while the operator is out of harm's way. So long as the circuit is not completed, — that is, until the terminal wires of the battery are united, — no action will occur; but at the instant of their union, the effect will take place. Hell Gate, in New York Harbor, was cleared of masses of rock in this way.

424. When the battery is of proper power, and the wires and sounding instruments are properly arranged, information may be transmitted from place to place by alternately closing and opening the circuit, and keeping it open or closed for a longer or shorter time, as may be necessary to make certain sounds which have been agreed upon as denoting certain letters and figures. Such a system is called a *telegraph*, and the science of producing such systems is called *telegraphy*.

There are various methods of detecting the times during which the circuit has been closed and open.

425. *Bain's* system consists of a roll of paper chemically prepared, and moved by clockwork, which becomes discolored by the electricity passing through the wire resting on the paper, and makes a record in dots and dashes.

426. *Morse's* system consists in training the ear to detect long and short sounds made as rapidly as the hand can open and close the key in forming the requisite sounds. In order to make the sounds more distinct, he has connected with the wires of the transmitting battery an instrument called a *relay*, which produces an increase in the power transmitted from the battery.

This instrument contains two pieces of soft iron around which wire is wound, and electricity passing through these wires makes magnets of them, and they are called electro-magnets.

The completion or breaking of the circuit at either end produces an attraction or repulsion at the other end of the wires and corresponding sounds.

The following table shows the signs used to represent letters and figures in the Morse system: —

LETTERS.			FIGURES
a - —	*j* — - — -	*s* - - -	1 - — — -
b — - - -	*k* — - —	*t* —	2 - - — - -
c - - -	*l* ——	*u* - - —	3 - - - — -
d — - -	*m* — —	*v* - - - —	4 - - - - —
e -	*n* — -	*w* - — —	5 — — —
f - — -	*o* - -	*x* - — - -	6 - - - - - -
g — — -	*p* - - - - -	*y* - - - -	7 — — - -
h - - - -	*q* - - — -	*z* - - - -	8 — - - - -
i - -	*r* - - -	*&* - - - -	9 — - - —
			0 ——

To prevent confusion, a small space is left after each letter, a longer one between words, and a still longer one at the end of a sentence. The operators in telegraph offices become so familiar with this alphabet that they understand a message from the mere clicks of the lever, and the paper and wheel-work that move it are now but little used.

427. *House's* system differs from the others principally in an arrangement by which the message is printed in ordinary letters as transmitted, at the rate of two or three hundred per minute.

Apparatus has been invented by which four messages can be sent on one wire at the same time, two in each direction.

428. We have seen that electricity, in passing through liquids, decomposes them into their elements; in its passage through solids, produces heat; and in its passage through air and gases, not only produces heat, but a violent projection of material particles, rendering them incandescent, accompanied by sparks and flame, as in case of lightning and the spark from an electrical friction machine.

We have yet to show that electricity generated by mechanical action, conducted through electro-magnets, produces all these and much more powerful results, and can be transformed again into mechanical action. This ought to be the *experimentum crucis*, or *absolute test*, in establishing as a fact the theory that electricity is a mode of motion, since it can be transformed into any of the other modes of force, or be produced by their transformation.

The late Professor Clerk Maxwell, the highest possible authority, made the declaration that "the discussion of the various forms of energy or force, with the conditions of their transformation from one form to another, and the constant dissipation of the force available for producing work, constitutes the whole of physical science."

429. In order to the better presentation of the work resulting from these transformations, we will here make brief reference to another form of this force, called *magnetism*, from its manifestation through magnets.

430. A *natural magnet* is a piece of iron ore known as protoxide of iron, or magnetic iron ore, probably called magnetic from Magnesia in Asia Minor, where first found.

Its peculiar property is that of attracting pieces of iron which are not magnetic. If bent in shape of a horseshoe, so that the portions of greatest attractive force are at the ends, two such magnets will attract each other if the opposite poles of each are presented. When a bar of such iron is suspended by the middle so as to turn easily, the same end will always be directed to the north pole of the earth, and the other to the south pole.

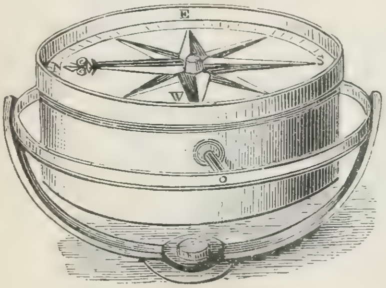


FIG. 75. — Mariner's Compass.

431. The *magnetic needle* of a compass is such a small piece of iron or steel balanced on a point, and is found very useful as a guide to indicate direction in sailing or travelling in an unknown country.

This needle also may be used to a certain extent to determine latitude, as its north pole gradually inclines toward the earth as it is carried from the equator toward the magnetic pole, until, just at the pole, the needle is exactly perpendicular to the earth's surface. The north magnetic pole of the earth was thus found by Sir James Ross in 70° north latitude and 96° 43′ west longitude.

The south magnetic pole was calculated by the same observer, in the South Sea, to be about 75½° south latitude and 154° east longitude.

432. The *declination* or variation of the magnetic needle east and west of the geographical meridian is continuous in one direction through a series of years, and then continuous in the other direction during another series of years. It was on the geographical meridian at Paris in 1663, and moved west until 1814, when 22° 34′ west; it then commenced to move in the opposite direction, and in 1875 was 17° 21′ west; and it is moving west about 10′ annually.

433. *Inclination* is the needle's tendency toward the earth.

434. *Declination* is the angle, east or west of the geographical meridian, which the needle makes with that meridian.

435. *Magnetic attraction* seems to act in curves from north to south.

The earth appears to be an enormous magnet, resulting from its rotation on its axis and the consequent existence of electrical currents circulating around from east to west.

These currents may be considered the results of the frictional action of currents of air of different densities, resulting from the influence of the sun's light and heat.

This theory of the magnetic influence of the earth is analogous to the action manifested by a helix or electro-magnet, before mentioned.

436. When an electric current passes through the wire, which is wound spirally around a piece of soft iron, as shown in Fig. 76, the iron then becomes a magnet, exhibiting polarity and attraction like a natural magnet.

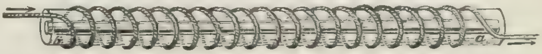


FIG. 76.—Electro-Magnet and Helix.

It is found by experiment that electricity always exerts a magnetic force laterally, or at right angles to its own direction of motion.

When a magnetic pole is influenced by electricity propagated in a conducting wire, it does not move directly toward or from the wire, but exhibits a tendency to revolve about it.

437. The discovery that rotary movements can be produced by magnets around conducting wires, and conversely that conducting wires can be made to rotate about the poles of magnets, has resulted in the invention of the electro-magnetic or *dynamo-electric machine*, so called because of the enormous power exerted by it and its application to the moving of machinery.

438. The helix or spiral coil (Fig. 76), sometimes called the *solenoid*, is usually made of copper wire, with silk thread or some other non-conducting substance wound around it.

The coils about the iron are repeated one over the other until it has the thickness necessary to give the desired power; for the magnetic power of the bar of iron increases in proportion to the square of the number of coils until it has reached a certain limit called its *point of saturation*, after which it increases only as the coils.

439. *The direction of the electrical current around the helix* determines which end of the bar will be the *north* and which the *south* pole. If it move in the direction of the hands of a watch, the north pole of the bar will be at the end of the helix opposite to that from which the motion is propagated, and the poles will change with each change of motion: hence, if the bar with its helix be revolved between the poles of a horseshoe magnet, the polarity will be twice changed with each revolution, and the motion in the helix will be alternately opposite; but, being in a circle, the motions will be united in a continuous, uniform motion from the machine to the conducting wire.

This reversal of polarity by alternately breaking and reversing the electric current is analogous to the method of storing electricity by the galvanic battery of M. Faure.

440. At the moment of producing and of stopping an electric current in a helix, the soft-iron bar thus magnetized gives forth a sound, which is attributed to the motion caused by the rearrangement of its molecules; and *it is found that the bar thus magnetized is lengthened*, though not changed in bulk.

441. Another evidence that magnetism is only motion, causing a rearrangement of the molecules, is given by a steel bar about three feet long, one end of which has been subject to the action of an electrical current in a helix. The end thus magnetized will raise quite a weight of nails, while the other exhibits little attractive power; but if we hold the bar in one hand with the magnetized end downward, and give the other end two or three sharp taps with a small steel hammer, the end thus struck will exhibit all the power before manifested

by the other end, while that end will have lost its attracting force. This power may be interchanged between the ends by alternately tapping the powerless end.

442. Permanent steel magnets may be made by placing steel bars centrally in a suitable helix, and connecting it with the wires of a dynamo-electric machine. The current must be broken before removing the steel.

A horseshoe magnet may be thus made by inserting one pole in one end of the helix, and, after breaking the current, withdrawing it and inserting the other pole in the other end of the helix, renewing and breaking the current before the magnet is withdrawn.

443. As the electric current in the opposite poles of magnets moves in the same direction, the unlike poles attract each other and the like poles repel each other.

444. As we have already stated, a magnetized bar can generate an electric current in a helix surrounding it in the opposite direction to that, which, by passing through the helix, made the soft-iron bar a magnet. To accomplish this motion, the wire must be moved past the magnet, or *vice versa*, to break as many lines of motion as possible. The electricity thus produced by a magnet is called *magneto-electricity*.

445. Professor Warner Siemens has devised an armature or bobbin (Fig. 77), in place of the ordinary helix, for dynamo-electrical machines, in which the insulated wire is wound longitudinally, or lengthwise, in deep grooves, on the soft-iron bar. To the ends of the cylinder brass disks, D and E, are secured, and with B is connected a commutator, C, consisting of two pieces of steel insulated from each other and connected respectively with the two ends of the wire. On the other disk is a pulley, *p*, round which passes a cord so that the bobbin moves very rapidly on the two pivots. When voltaic electricity moves in the wire, the two cylindrical segments A and B are immediately magnetized with opposite polarities.

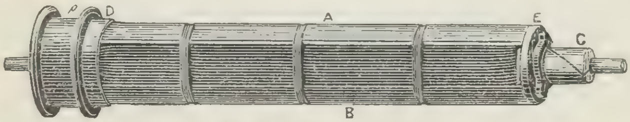


FIG. 77. — Siemens Armature.

If, instead of passing a current of electricity through the wire of the bobbin, the bobbin is itself made to revolve rapidly between the opposite poles of magnetized masses, as the segments A and B become alternately magnetized and demagnetized, their induction produces in the wire a series of currents, alternately positive and negative; and these currents are collected in the commutator C, one of whose springs sends all the positive electricity, and the other all the negative electricity, around the conducting wire, just as when the poles of a battery are united. This may be revolved between the poles of many small magnets instead of one large one; but in either case it is a powerful dynamo-electrical machine.

446. The *Gramme dynamo-machine* is now generally used, as it gives a uniform and more powerful current; but the principle is the same as above, — the alternate cutting off and

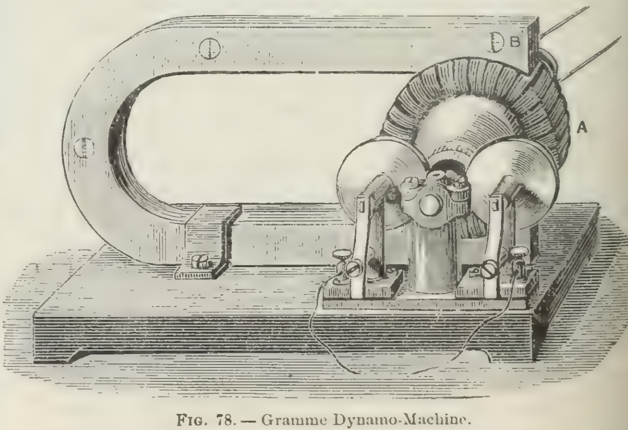


FIG. 78. — Gramme Dynamo-Machine.

reuniting as many lines of electrical motion as possible. It is represented in Fig. 78.

447. All bodies are either attracted or repelled by powerful electro-magnets. Those repelled are called *diamagnetic*.

448. For the purpose of further indicating that magnetism is only a form of motion, we give one or two of the experiments of the celebrated mathematician M. Bjerknes, in his calculation of the vibratory motions of bodies in a medium. Example: In a basin of water there is placed a small frame carrying a drum fixed on a revolving axle, and communicating with one of the air-cylinders of an air-pump. The operator holds in his hand a second drum communicating with the other cylinder. The pistons are so arranged as to move parallel with each other; then the ends of the drums inflate and collapse at the same time.

The motions are of the same phase or appearance; but if the drums are brought near each other, a marked attraction occurs, — the revolving drum follows the other. If the cranks are so adjusted that the pistons move in opposite directions, the phases are discordant, repulsion takes place, and the movable drum moves away from the other. The drum behaves like the insulated pole of a magnet.

These effects are more easily shown with vibrating spheres, where the vibrating sphere presented to the movable drum is repelled or attracted according as the side approached is concordant or discordant with the end of the drum facing it.

By use of the floats B, C, in Fig. 79, may be represented phenomena analogous to electro-magnetism, or magnetism by induction.

If we present the body B, which is a small metallic sphere, either to a drum which is caused to pulsate as above mentioned or to an oscillating sphere, it will be attracted, thus representing the action of a magnet upon a piece of soft iron.

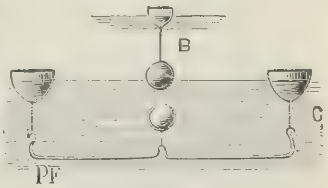


Fig. 79. — Attraction in Liquids.

If C, which is a sphere lighter than water kept in the liquid by a weight, be presented to the vibrating body, it will be repelled, and we shall obtain the results known as diamagnetism.

If we present to each other two drums of opposite phases, but so arranged that one vibrates faster than the other, we shall find, on bringing them together, that the repulsion which manifested itself at first is changed to attraction. On approaching each other, the drum having the quicker motion has finally upon the other the same action as if the latter were immovable; and the effect is analogous to that which takes place between a strong and weak magnet when their like poles are presented to each other.

Faraday attributed these magnetic influences to the difference between the attraction exerted by the magnet upon the body under experiment and the attraction exerted by the air, and considered that, if the body were more sensitive than the air, direct *magnetism* resulted; but if less sensitive, *diamagnetism* would be the result. In the above experiments, water acts in the same capacity as air in the case of magnets.

In short, it seems like the principle of specific gravity; and it is more than probable that gravity will be found to be only another mode by which matter exhibits itself in motion.

449. Having now sufficiently described all the means for the generation of electricity, we will mention some of the principal methods of transforming it into work; and that it is actually transformed into various forms of work the galvanometer, or electricity-measurer, shows.

450. When Faraday in 1846 made the discovery that light could be produced by the separation of two carbon rods conducting electricity of considerable intensity, the possibility of electric lighting on a large scale was first presented to the minds of scientists.

The effect appeared due to the rarefaction of the air by the great heat of carbon in rapid combustion, and to the passage of incandescent particles of carbon from pole to pole, thus reducing the resistance always offered by air to the passage of electricity.

Years spent in the study of the subject seem to have satisfied the advanced scientists that such division of the electric light as would be necessary to the lighting of extensive areas was impossible; but fortunately there were men so little scientific in theory that they were not prevented from experimenting until they succeeded in producing practical results. And within a year, two classes of lights have been produced which seem specially adapted to the uses made of them.

451. The first is called the *arc-light*, and its principle has already been stated above as consisting in passing an electric current between two carbon points.

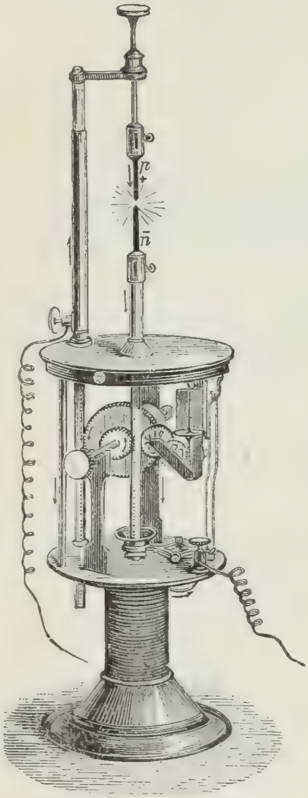


FIG. 80. — Arc-Light.

In order, however, to produce an electric tension of sufficient force to allow any considerable subdivision of this light, it was necessary to invent powerful machines that would give a uniform motion to the current; and this has at last been accomplished in the *dynamo-electric* machine, and particularly that of Gramme. But, in order to use this machine, a gas or steam engine, or some mechanical power, is required to give rapid motion to the coils; and some of this power is lost in overcoming the friction of machinery, so that in no case can more than two thirds of the force of the engine be utilized. Where water-power can be used, it will be most economical.

On account of the great resistance offered by the atmosphere and carbons at the arc, the power of subdivision of the light is comparatively limited. In one light the candle-power may be as high as one tenth of the number of foot-pounds of power employed; but when the attempt is made to divide a light, — for instance, of 4,000 candle-power into twenty arc-lights of 200 candle-power, — it cannot be done, for much electro-motive force presents itself at each arc in an opposite direction to the advancing current.

A division can, however, be made with considerable loss of power at each arc, though the largest number of arc-lights yet produced by one machine is forty.

The carbons which produce the arc-light are gradually consumed; hence the space between the points would continually increase with loss of lighting-power were it not for a self-regulating apparatus which keeps the points uniformly at the same distance apart. This light is said to show precisely the same spectrum as does sunlight, and is claimed to be identical in action.

The coolness of the electric light is due to the absence of that large excess of less refrangible or heat-radiating rays, which is found nearly alike in all other modes of artificial lighting; and this absence of heat-rays is due to the almost perfect combustion of carbon material, and the consequent transformation of nearly all the heat, on account of its great intensity, into light. This light is used for lighting large areas, as streets of cities.

452. The other class of electric light is simpler in construction and more direct in action. It is called the *incandescent light.*

To produce this light, beside the usual generating machine and conducting wires, it is necessary to have at each lamp, to receive the current of electricity and transform it to heat and light, a rather poor conductor of electricity formed into a wire loop or curve; and it must be either non-combustible in air, or unchangeable in a vacuum. Carbon seems to be the best substance for this purpose, because, as compared with the only other substance, platinum, which can be used in this way, it is infusible.

It has, however, been found difficult to manage, on account of its combustibility; yet, by repeated experiments and indomitable perseverance, Mr. Edison of New York, and Mr. Swan of England, at about the same time, succeeded in producing lamps which give satisfaction to all who use them.

The lamps are substantially the same in principle, though Mr. Edison's proves more durable; Mr. Swan using a fine carbonized paper filament, while Mr. Edison's lamp consists of a single curl or loop of carbonized bamboo, no thicker than a hair, placed in an exhausted glass bulb. Notwithstanding the extreme fineness of the loop, it possesses the elasticity of a steel spring, and will endure electric currents of great force.

These lamps were not serviceable at first, because the air was not sufficiently exhausted from the bulb and the carbons were soon consumed by oxidation; but a more perfect vacuum was finally formed by passing a greater current of electricity through the carbon in the bulb than it would subsequently be subjected to, and at the same time exhausting the air. The bulb is sealed while these actions are taking place.

Each lamp is subjected to this process, and is made air and water tight.

Each carbon, by a wire passing through the bottom of the lamp, is brought into connection with the conducting wires from the battery or dynamo-machine, upon screwing the lamp into a socket prepared for it.

Whenever a carbon is destroyed or the lamp otherwise injured, a new lamp can be screwed into the socket in place of the old lamp, and is at once ready for use. If the bulb of the lamp be broken, the light will be extinguished instantly, and no further harm results.

The danger which formerly existed in case of the wires coming in contact, on account of unusual heat produced by the shortening of the circuit, has been removed by "safety catches," which consist of small pieces of lead wire inserted in the circuit, which, by fusing readily, break down the section in which they are placed, whenever the current becomes too powerful for safety, thus avoiding all danger.

This rupture does not affect the lamps of other sections; and, as soon as the lead is replaced, the lamps of the broken section are immediately relighted.

Apparatus has been invented by which the amount of electricity can be regulated, and the same effect produced as by partially turning on or off a current of gas in case of gaslight. In order to light a lamp it is only necessary to turn a cock exactly similar to a gas-cock, and matches are not required.

The desirableness of this lamp consists not alone in its soft, clear light, but in its freedom from the heating and air-vitiating qualities of other artificial lights.

The subdivision of this light is limitless, and depends only upon the *quantity* of electricity produced, and not upon the *tension* or *electro-motive* force, as does the arc-light.

The success of this subdivision was only secured after numerous experiments, and yet, when obtained, seemed so simple that the inventor undoubtedly was vexed at his stupidity in not at once thinking of it; but it is one of the greatest accomplishments of the age.

It is effected by running the conducting wires side by side and placing the lamps between them in connection with both, so that, as the electricity in quantity moves along the conducting wires, a sufficient amount passes into each lamp to produce the light; and the greater the quantity, the brighter the light.

It has been illustrated by one scientist in this way: Two canals conveying water are cut along the side of a hill, one above the other, at a distance of $\frac{1}{50}$ or $\frac{1}{100}$ of the height of the hill. The upper canal is connected with the lower at 50 or 100 places by sluices, in each of which is a water-wheel; and, as the upper canal is always kept full, each sluice will have a sufficient quantity of water pass through it to the lower canal to keep its wheel running, and if any wheel gets out of order it in no way affects the others. Mr. Edison is now engaged in laying 500 miles of underground mains in the city of New York, under agreement to furnish each dwelling with light at the same rate as gas is now furnished.

453. The heat used to develop one horse-power of force will give light according to its application, as follows:—

Gas		=	12 candles.
Gas used in an engine working an electric generator,	for 1 arc-lamp	=	1,600 "
	for 10 incandescent lamps	=	160 "

These differences result from the differences of temperature. A large quantity of heat at 212° Fahr. gives no light, but a small quantity at 1,000° would give a bright light.

The arc-lamp is more economical than the incandescent lamp for the reason that it admits of electrical action of greater intensity; thus producing heat of a higher temperature and lessening the quantity expended, while increasing the brilliancy of the light.

As at present constituted, the carbons of the incandescent lamps will not endure the high temperature of the arc-lamps, hence require a greater quantity of electricity at a comparatively low temperature; but their construction will in time undoubtedly be so improved as to render them more economical.

The incandescent light admits of unlimited subdivision, because the circuit is not broken; hence the resistance is only that of the conducting wires: while the arc-light is limited in division because it only acts by the breaking of the circuit.

Mr. Brush, however, of the Brush Arc-Light Company, claims to have lately increased the power of his machines by so arranging the commutator as to cut off that portion of the wires which is inactive during polarization, thus reducing the resistance; and he also claims to have discovered a way by which he can store the superfluous electricity which his machine generates during the day, and make use of it during the night, so as not to necessitate the running of the machine at night.

454. In order to measure the quantity of electricity used in performing any work, the following units have been agreed upon:—

A *volt* is the unit of electro-motive force. Sixty or seventy volts will maintain an arc-light.

An *ohm* is the unit of electrical resistance, and equals a column of mercury whose sectional area is one square millimetre, and whose length is between 104½ and 105½ centimetres.

The *exact* length is to be determined by the next electrical congress.

The unit of current is called an *ampère*, and is the current that one *volt* can send through one *ohm*.

The unit of quantity is called *a coulomb*.

455. *One horse-power* can maintain a current of one ampère through 746 ohms, or 10 small incandescent lamps. Sixty volts would send a current of 10 ampères through an arc having a resistance of 6 ohms. This equals the force necessary for a Brush lamp.

456. It can hardly be doubted that electricity is, in the near future, to be universally used for lighting purposes in place of gas, and greatly to the advantage of all as regards health and safety.

At present, at the Paris Electrical Exhibition, are to be seen some of the most beautiful conceivable representations of this light, some of them taking the forms of various flowers by the insertion of incandescent lamps in brass, hammered into the shapes of flowers of different kinds. This subject of electric lighting is so absorbing the minds of all classes of people that it even manifests itself in the production of a small battery-lamp for cigar-lighting. What wonders are to come in the next decade can only be imagined.

Electricity is, however, destined not only to be a universal illuminator of the darkness, but to become a motive-power in many ways now only dreamed of.

Many of the physical defects of humanity have been relieved by it, and the deaf may yet be made to hear and the dumb to speak.

We doubt not that the mighty cataract of Niagara will yet be brought in subjection and forced to light the cities of New York State.

But how can this be done?

By making that fall of water turn gigantic wheel-machinery which shall give such immense velocity to the dynamo-machines yet to be constructed that their electro-motive force shall not only permit great subdivision of the arc-light, but the transformation of the electrical current into powerful mechanical movements.

We know that, if the wires of a Gramme machine be conveyed for miles and then connected with the coil of another similar machine, it will be caused to rotate and set in motion wheel-machinery connected with it, reversing the action of the first machine which is set in motion by a gas or steam-engine, or by water-wheels, or by other mechanical force.

In this way the trains on several short railways are at present run. The current from the first dynamo-machine sent along one of the two rails, or an intermediate one between the two carriage-rails, is taken up by brushes and communicated to a second dynamo-machine situated on the platform of the driving-car. This second machine is connected by bands or otherwise with the driving-wheels, and by its rotation puts the car in motion at a rate varying from 7 to 12½ miles per hour. This rate can be increased at will to 25 miles per hour.

The electricity is returned to the first dynamo by the driving rails, if there is an intermediate rail, or, if no intermediate rail, by the rail opposite to that on which the current was sent.

Among the various kinds of mechanical work performed by electricity, an exhibition of which may now be seen at the Paris Exposition, are ploughing, printing, rock-boring, machine-stitching, glass-cutting, wood-cutting, the raising of weights, etc.

While electricity may thus have a possible application to all kinds of work, on account of the imperfection of insulated wires and the loss of power in overcoming friction, its use can only be economically made at present in producing light, and in transmitting to a distance, storing, and transforming, the otherwise waste power of tides and falls and winds, the surface forces of the earth.

If it never have further application, however, the forces thus utilized will save millions of tons of fuel, and add millions of foot-pounds annually to the possibilities for work, and increase in many ways the safety and comfort of mankind.

THE TELEPHONE.

457. Professor Preece says the earliest document in which the transmission of sound to a distance is distinctly formulated dates from 1667, and is a paper by Robert Hooke, who states that a whisper may be heard at a furlong's distance, and probably ten times that distance; and that he knows a way by which a person speaking may be heard through a very thick wall; and further, that he has, by the help of a distended wire, although bent in many angles, propagated sound to a very considerable distance, with apparently the same rapidity as light passes.

This method was doubtless similar to that of the *string telephone*, which attracted attention for several years before the invention of the speaking telephones which make electricity the means of transmission.

These string telephones are made of two metal or card-board tubes in the form of a hollow cylinder, across one end of which is tightly stretched a membrane of parchment, in the centre of which the string connecting the cylinders is fastened.

When a person places one of these cylinders to his ear, and another person talks with his mouth close to the opening of the other cylinder, the string being tightly stretched, his words may be plainly heard by the first person one eighth of a mile distant.

In this case the vibrations of the membrane affected by the voice are mechanically transmitted by the string to the other membrane, and, being exactly reproduced, would give the same notions to the mind of the person listening as though he had been sufficiently near to hear without the instrument.

458. It is the same principle of reproduction of vibrations that applies to all speaking machines.

In the Bell, Edison, Gray, and other late inventions for distant speaking, electricity is made to assist in the conveyance of sound-vibrations and their reproduction.

It accomplishes this on the same principle that it conveys telegraphic signs; and so clearly is this the case that the English government will make no distinction, and is now using the telephone in connection with the telegraphic service, of which it has assumed entire control.

But more delicate and complicated transmitting and receiving instruments must, of course, be used in reproducing words than in the simple repetition of long and short sounds, as in the telegraph, for many combined vibrations must be transmitted at the same time.

The design of all telephonic instruments, therefore, is to create as intense vibrations as possible in the wires connecting with the general conducting wires, that each variation of the voice may be transformed into electrical motion, and retransformed into sound-vibrations at the other end of the circuit.

There are many kinds of telephonic instruments, and we can only describe one or two of those which give the best results.

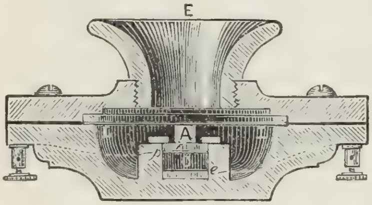


Fig. 81. — Edison's Transmitting Telephone.

459. Fig. 81 represents a vertical section of the model of *Mr. Edison's transmitting telephone*, which has produced the best results.

The vibrating plate L L is supported on the disks of a secondary carbon conductor C, by means of a little iron cylinder A, and the pressure is regulated by a screw *e*, placed underneath.

The rigid disk *b*, resting on the first platinum plate *p*, is of aluminum instead of ebonite, as in the earlier constructed instrument. E is a tunnel-shaped mouth-piece.

460. Fig. 82 represents his *receiving* telephone, which somewhat resembles Mr. Bell's, but presents differences which will be seen in the following description.

The magnet N S is in form of a horseshoe, and the magnetizing coil E only covers one of the poles N; this pole is exactly in the centre of the vibrating plate L L, whose surface area is about that of a silver dollar, while the second pole S is near the edge of this plate.

The plate is enclosed in a circular groove, which keeps it in a definite position. In consequence of this arrangement the handle is of solid wood, and the vacant space for the electro-magnet system is somewhat larger than in the Bell receiver.

An arrangement is made for subduing the echo, and there is a sounding-box to magnify the sound.

The relation which the electro-magnet system bears to the vibrating disk increases the sensitiveness of the instrument, because the pole S is in close connection with the disk L L, which becomes polarized, and is thus more susceptible to the magnetic influence of the pole N.

In both the receiver and the transmitter the upper part C C, corresponding to the vibrating disk, is screwed to the handle. The instrument wires A A are connected with the conducting wires.

Mr. Edison has varied his instruments in many ways, and of late their cases have been made of metal with a funnel-shaped mouth-piece of ebonite.

Finding induced currents more favorable to telephonic transmission than are voltaic currents, he transformed the currents passing from the battery through his sender by making them pass through the primary circuit of a carefully insulated induction coil; the line wire was then put in connection with the secondary wire of the coil. This is a combination to be found at present in nearly all systems of telephones.

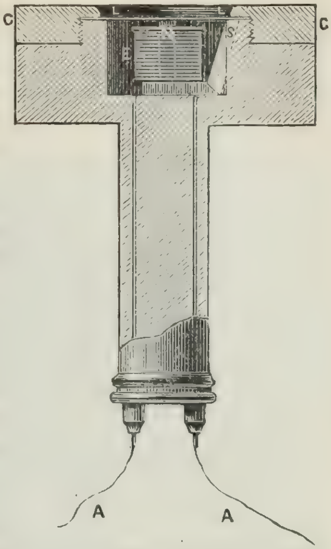


Fig. 82. — Receiving Telephone of Edison.

Mr. Edison is now exhibiting a telephone in Paris by which a full orchestra of music can be enjoyed by a roomful of people at a great distance from the orchestra.

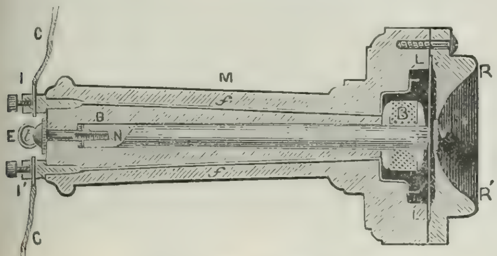


Fig. 83. — Bell's Telephone.

461. The ordinary arrangement of the *Bell* telephone is represented in Fig. 83, and consists of a cylindrical wooden box fitted to the extremity of a wooden handle M, which contains the magnetic bar N S. This bar is fitted by a screw *t*, and is moved forward and backward by tightening or loosening the screw.

At the free extremity of the bar the magnetic coil B is fixed, made of wire No. 42. The ends of the coil terminate in two copper rods *f f*, which extend through the handle and are fastened to two binding screws I I′, where the line wires are fixed.

Above the pole of the magnetic bar N S is placed the iron vibrating plate L L, which has a very thin coat of black or yellow varnish. This plate is in the form of a disk, and, by its rim resting on a caoutchouc ring, is firmly fixed to the circular edges of the wooden box, which is made in two pieces for this purpose.

These pieces are adjusted to each other by screws or spirals cut in the wood.

The disk is placed as near as possible to the polar end of the magnet, without causing them to touch when vibrated by the voice.

The mouth-piece R R terminates the upper part of the box, and leaves a small space between the disk and the edges of the hole V, which is open in its centre.

The receiver is like the sender, and a voltaic battery is not required.

462. Different inventors have established systems of general telephonic communication in cities and large towns, by which individuals in different locations may have connection made between their own telephone and any other in the city or town. This is accomplished

by means of a switch at a central office, which is used to connect any one wire with any other wire in the system.

The principal objection to them has been that no communication could be secret, as any one having an instrument on the same line could hear all that might be said.

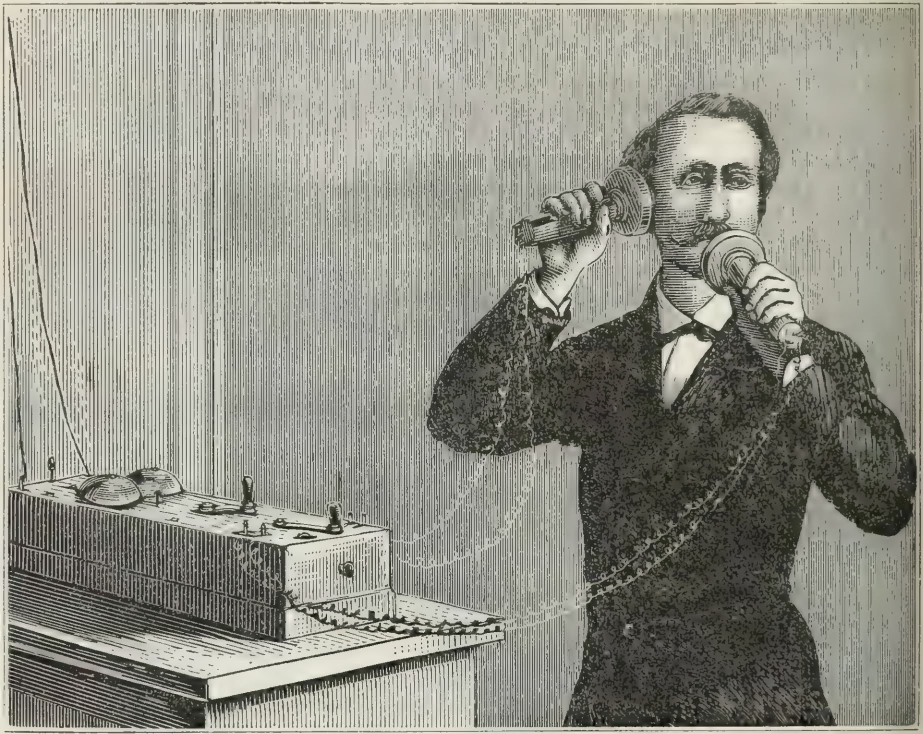


FIG. 84. — Bell's Telephone in Operation.

Within a few weeks, however, it has been claimed by certain inventors that they have constructed a system by which communication can be made without other persons on the line receiving the message.

463. The MICROPHONE is only the sender of a battery telephone, and was so named because by it very minute sounds could be heard. It is very similar in principle to Mr. Edison's telephone transmitter; and we will not describe it, but merely say that its forms are numerous and its uses various.

It can not only transmit speech, but, under certain conditions, act as a receiver. It is used in scientific research in the study of vibrations imperceptible to our senses, in medicine and surgery, and in forming systems of "relays" for telegraphy.

THE PHONOGRAPH.

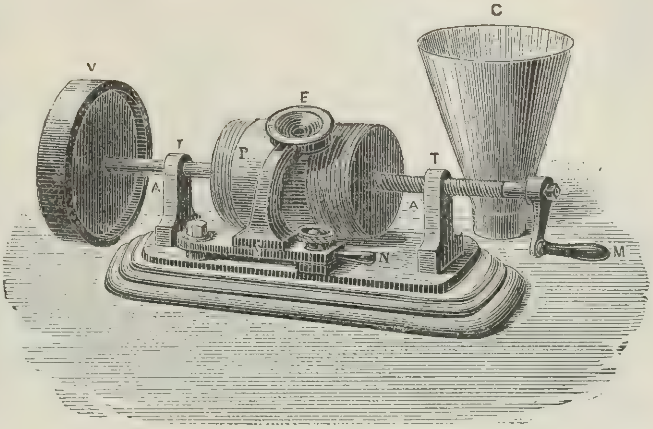


FIG. 85—Phonograph.

464. The *PHONOGRAPH* is an instrument which registers the different vibrations produced by speech on a vibrating plate, and reproduces the words in correspondence with this registration.

When the person speaking stands before the mouth-piece E (Fig. 85), and uses forcible utterance, and at the same time turns the handle of the cylinder, which has a heavy fly-wheel to make the motion regular, the plate L L (Fig. 86) vibrates and sets the tracing-point S at work, which presses on the tin-foil at each vibration, and produces a furrow whose depth varies in accordance with the unequal vibrations of the disk.

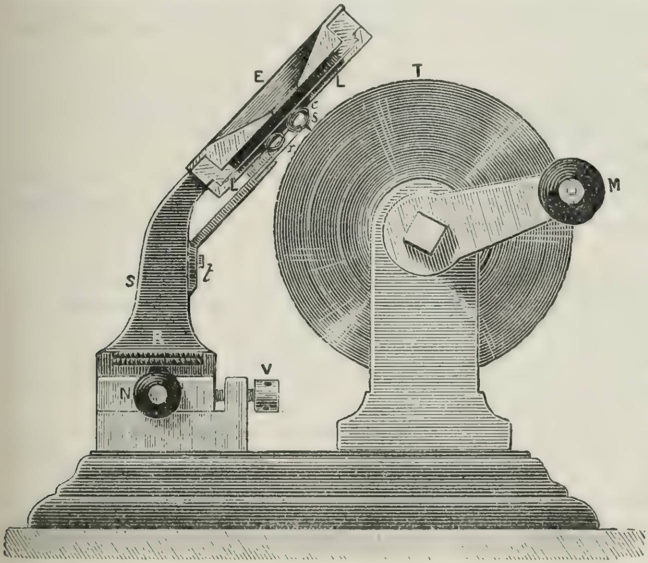


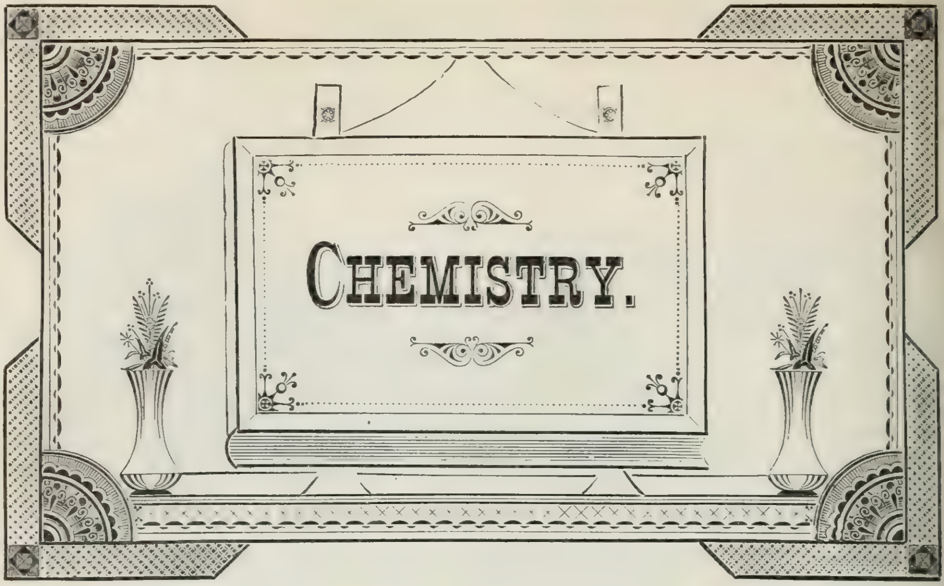
Fig. 86.—Phonograph (End View).

The cylinder moving sideways presents the different parts of the groove to the tracing-point in succession, so that, when the spoken sentence comes to an end, the reliefs and depressions in succession constitute the registering of the sentence.

In order to reproduce the sentence, it is only necessary to readjust the machine, and repeat the process of turning the cylinder.

The point is forced to follow the elevations and depressions of the groove, and thus vibrate as when it traced the groove, and these movements cause corresponding vibrations in the plate; hence the words originally spoken are the result. The words thus reproduced may be heard in all parts of the hall.

With this description we end our discussion of physics, leaving the imaginations of our readers to roam fancy free in their conceptions of the wonderful inventions which will soon undoubtedly eclipse those here mentioned.



CHEMISTRY.

1. Of the three kinds of absolute change constantly occurring in the universe, we have, under the head of Physics, already treated of those affecting bodies in bulk; viz., **change of place** and **change of form**, resulting from motion or force among the molecules of matter

2. The **third kind** of **change** relates to the **composition** of **substances**, and its treatment is the special province of chemistry.

Substance is the peculiar form under which matter presents itself.

Changes of composition of substances are **chemical** changes, because they involve the constitutional union and separation of the ultimate **atoms** of matter, the reason for, and manner of, which are unknown, hence — from **Kimia**, *hidden* — called **chemical.**

Chemical change occurs when rust, so called, forms on the surface of a metal; when wood or coal is said to burn; when a cut of a person's flesh heals; when animal or vegetable substances decay; when mineral substances crumble on account of the action of air and rain, and when life is supported by food and air.

3. The desire of mankind to penetrate the mysteries of nature, as manifested in these ultimate constitutional changes, has ever been seen in the acts of studious men, and gave rise to **alchemy,** when gold and silver became of such value that the natural supply was not equal to the demand.

The **alchemists** endeavored to produce these metals by taking apart the constituent elements of bodies, and using them in the production of new compounds. The taking apart is called **analysis**; and the putting together, or rearrangement, is called **synthesis.**

4. How natural it is for any one to ask himself or others concerning an unknown substance, Of what is it made? what is the process? what is the effect of bringing it in contact with certain known substances?

The classified knowledge obtained in the endeavor to answer these questions is called **Chemistry**; and the systematic study of the reasons for, or the causes of, these phenomena, is the **science** of chemistry.

To the extent that our space will permit, we shall pursue the natural course of inquiry.

5. Naturally we would first like to know *what constitutes the air we breathe*, that renders it capable of supporting life, and effecting all the changes manifestly due to it.

We cannot see air ordinarily, because it is transparent, and does not reflect light as most liquids and solids do. Its molecules move freely upon one another, and cannot be separated as liquids and solids are. Hence we call it an **invisible gas.** But we are not satisfied with this conclusion, and endeavor to ascertain the composition of this invisible gas. After many experiments, we at last find a way of separating air into its principal elements.

We might show that the air is not a single element by extracting from iron-rust, or any metal **rust**, whatever has united with the metal to produce the rust, and then compare this substance with air. That something from the air does unite with metals to produce rust, we know from the fact that the rusted metal weighs more than the polished metal; and from the fact that the metal rusts quickly when heated in the air, but not at all when heated in a vacuum. But the best substance for our purpose, showing the composition of air, is **metallic mercury**, because the substance which produces the rust can be easily expelled from the mercurial compound — "**red oxide of mercury**" — which results from long-continued heating of mercury in air. (Fig. 1.)

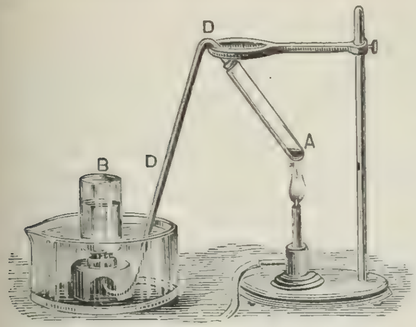


Fig. 1. — Quantitative Analysis of Air.

Example. — Enclose in a thick tube of hard glass a measured quantity of air and a certain weight of mercury; and have fitted, air tight, to the mouth of the **ignition** or heating **tube**, A, by means of a perforated cork, a delivery tube, D, conveniently bent for passage beneath the receiver, B, inverted in a basin of water.

Heat the mercury in the ignition-tube, inclined as in the figure, until chemical change in the mercury ceases, and there will be found remaining in the tube a gas differing from air in that it will not support combustion or life, and does not weigh so much, and is only about four fifths of the volume of the quantity of air first introduced into the tube. This gas is called **nitrogen**, probably because first found in **nitre**. We shall speak of it more fully hereafter.

Having now withdrawn the nitrogen from the tube, we find remaining the "red oxide of mercury," which, the air being exhausted from the tube, we subject to the heat of a gas flame as before, and we soon see bubbles of some kind of gas arising through the water in the basin into the receiver. As soon as the gas ceases to rise into the receiver, remove the delivery tube from the water, and metallic mercury, such as, and the same in weight as, we first put in the tube, will be found in the ignition-tube, and the gas in the receiver will be found to be one fifth of the bulk of the air originally put in the tube, and of less weight. We find that it supports combustion and life; but so intense is its action that the tissues of the body cannot be replaced by nature so rapidly as they are removed by the gas, and life must soon be destroyed by the very rapidity of living. This gas is called **oxygen**, because it was formerly supposed to be the generator of acids.

Thus we find that the atmosphere is composed of oxygen and nitrogen, in the ratio of one to four as regards its volume; and we find also by mixing these elements in the above ratio, which is done perfectly on account of the diffusibility of gases, as mentioned in physics, that we have air in all respects like the atmosphere, and this without any evolution of heat, light, or electricity, which must be produced when chemical change takes place: hence we know that the atmosphere is only a **mechanical mixture** and is not a **chemical compound**. There is in fact an exceedingly small quantity of watery vapor and carbonic acid; but, as both united are less than one per cent, we, in speaking, generally ignore them.

6. **Oxygen** and **nitrogen** are called **elements** because it has been found impossible to decompose them. They are mixed in air in order that oxygen may be taken into the lungs in a diluted state, and not consume the tissue more rapidly than nature can supply it. **Nitrogen** is used as the diluent because it does not readily combine with other substances, and is colorless, odorless, tasteless, and inert; hence can be taken into, and forced out of, the lungs without change.

7. Our curiosity is next excited by the peculiarities of *water*, which we need only little less than air. *What is its composition?*

We might put a small piece of sodium under a receiver filled with water, and shortly find that the metal has disappeared, and the receiver contains a gas which has partially expelled the water; but we should wonder what had become of the metal, and whether it had or not been changed into the gas in the receiver. The gas thus obtained burns with a feeble light when held over a flame. This gas is called **hydrogen**, — water-generator.

We wish no unknown quantities to enter into our problem; hence we use a means by which we can eliminate all doubtful factors.

The best method is called **electrolysis.** As it has been shown in physics that electricity is only a mode of motion, we can have no doubt of the correctness of the result thus obtained; yet, to leave no loophole for escape, every precaution will be taken. We will measure the quantity of water contained between certain marked limits of a vessel in which are electrodes in glass tubes, *c*, *d* (Fig. 2). Over each tube we will arrange receivers for catching the gaseous products which may come from the electrodes, *h* and *o*. When these electrodes are attached to the wires of a galvanic battery, some kind of gas is produced at each pole. After the water between the marked limits of the vessel has been decomposed, we disconnect the battery, and find that one receiver has just *double the volume* of gas that the other has, but only *one eighth the weight*. The gases therefore cannot be the same. To ascertain the nature of each gas, we re-connect the battery with the electrodes, and catch a little of each gas in separate vessels, and find that the gas coming from the positive pole — and which is least in volume — presents all the phenomena of *oxygen;* while the other presents the same phenomena as the gas caught when sodium was dropped on water, and which is called *hydrogen.*

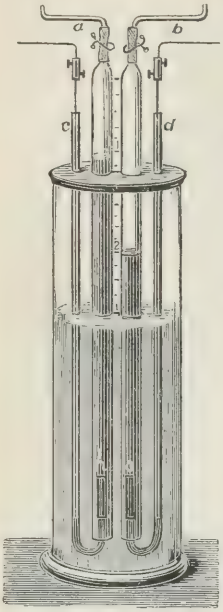


FIG. 2.

We believe, then, that *water* is composed of *oxygen* and *hydrogen* in the ratio of *two* volumes of the latter to *one* of the former; the two volumes of hydrogen weighing one eighth of the one volume of oxygen.

To make ourselves certain of our conclusion, we now bring together in *one* receiver, A (Fig. 3), the gases first obtained by electrolysis, and pass the electric spark through them by means of the funnel-shaped tube, B, from which the air has been exhausted before connection, when instantly an explosion takes place, and we find in the receiver the water we had lost by the action of the battery.

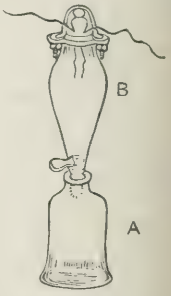


FIG. 3.

8. Having now shown some of the methods of analysis, and discovered the three most abundant *elements* in nature, *oxygen*, *nitrogen*, and *hydrogen*, we will name in classified order all the known *elements*, giving their *symbols* and *atomic weights*, because we shall frequently use the symbols instead of the names.

But, before giving the *table of elements*, it may be well to state a few facts in form of definitions, which will aid the reader in comprehending the table.

9. According to Boyle's law: —

"*In equal spaces, at equal temperatures, and under equal pressures, all gases have an equal number of molecules.*"

10. A **molecule** is the least portion of matter that can exist in a "*free*" state (or by itself), or take part in a chemical change.

11. An **atom** is the least portion of matter that can exist in chemical combination.

If we take **X** atoms of hydrogen, or **H**, and unite it with **X** atoms of chlorine, or **Cl**, the result will be *two* **X** times **H Cl**, or hydrochloric acid. But each atom has been united to another atom, and we should expect it would be contracted to the volume of either atom. This, however, is not the case, for the volume of the combination is equal to the volume of both the separate atoms; hence, according to Boyle's law, there will be *four* **X** *atoms*, instead of *two* **X** *atoms*, in the compound, and *two* **X** *molecules* instead of *one* **X**. We say, therefore, that a *molecule* composed of *two atoms* is the smallest portion of matter that can exist in a "*free*" state; and an *atom* the smallest particle that can enter into *chemical union.*

12. Bodies are divided, as regards their condition, into *solids*, *liquids*, and *gases*.

They are divided, as regards their characteristics, into *metallic* and *non-metallic;* and, as regards their combining action, they are called *positive* and *negative radicles*.

13. A substance long known has its old name retained in modern chemistry.

14. The names of metals generally end in *-um*.

15. **Symbols** are the initial letter or letters in the names of *elements;* or, in compounds, a combination of the initial letters of the elements forming the compound.

16. The names of compounds are composed of the names of simples, the metallic body occurring first as an adjective.

17. Each chemical symbol has associated with it a certain *number*, called the "*atomic weight*," because the weight of that particular substance, or some multiple of that weight, is always found in combination with other substances; hence the conclusion that a *single atom* weighs just so much as compared with hydrogen.

18. **Hydrogen,** being the lightest substance known, is taken as the *unit* of "*atomic weight*," and is also adopted as a *monad*, or measure of combining volume.

19. A *monad*, in *other cases*, therefore, is an element whose single atom can unite with a single atom of hydrogen, or take the place of hydrogen in a compound.

20. **Quantivalent** refers to the number of hydrogen atoms, or their equivalent, with which an atom of a substance can unite

Hence, if an atom of a substance unites with one atom of hydrogen, it is called a *monad;* if with two atoms, a *dyad;* if with three atoms, a *triad;* if with four, a *tetrad;* if with five, a *pentad*, etc.

21. The **equivalent** of bodies is obtained by dividing the "atomic weight" by the quantivalent.

22. The equivalents of iron and sulphur vary, because their quantivalents vary.

Iron may be either a triad or a tetrad. *Sulphur* may be a dyad, a tetrad, or a hexad; that is, may unite with two, or four, or six atoms of hydrogen.

23. **Chemism** is a mode of motion.

Change of quantivalency generally occurs in pairs, as in sulphur; and this change in a body results in a change of the mode of motion.

24. A *compound radicle* is a compound of simple radicles united in a group behaving as a simple.

The quantivalent of a compound radicle is determined by diminishing the quantivalent of one of the simples by *one* for every equivalent part that is added.

25. Table of the Elements, with Reference to their Quantivalency, their Symbols, Atomic Weights, etc.

		Name.	Symbol.	Approximate Atomic Weight.	State.	Color.
Monads.	*Non-Metallic.*	Hydrogen,	H,	1.	Gas.	None.
		Fluorine,	Fl,	19.	"	"
		Chlorine,	Cl,	35.5	"	Green.
		Bromine,	Br,	80.	Liquid.	Orange-red.
		Iodine,	I,	127.	Solid.	Black.
	Metallic.	Silver (or argentum),	Ag,	108.	"	White.
		Potassium (or kalium),	K,	39.	"	"
		Sodium (or natrium),	Na,	23.	"	"
		Lithium,	Li,	7.	"	"
Dyads.	*Non-Metallic.*	Oxygen,	O,	16.	Gas.	None.
		Sulphur,	S,	32.	Solid.	Yellow.
		Selenium,	Se,	78.	"	Black.
		Tellurium,	Te,	128.	"	White.
	Metallic.	Lead (or plumbum),	Pb,	206.	"	Bluish-white.
		Mercury (or hydrargyrum),	Hg,	200.	Liquid.	White.
		Barium,	Ba,	137.	Solid.	Yellow.
		Strontium,	Sr,	87.	"	"
		Copper (or cuprum),	Cu,	63.	"	Red
		Zinc,	Zn,	65.	"	Bluish-white.
		Calcium,	Ca,	40.	"	Yellow.
		Magnesium,	Mg,	24.	"	White.
Dyads, which under certain circumstances are *tetrads* or *hexads*.	*Metallic.*	Cobalt,	Co,	59.	"	"
		Nickel,	Ni,	59.	"	"
		Iron (or ferrum),	Fe,	56.	"	"
		Manganese,	Mn,	55.	"	"
		Chromium,	Cr,	52.5	"	Gray.
		Aluminum,	Al,	27.5	"	White.

		Name.	Symbol.	Approximate Atomic Weight.	State.	Color.
TRIADS.	*Non-Metallic.*	Boron,	B,	11.	Solid.	Brown.
		Nitrogen,	N,	14.	Gas.	None.
		Phosphorus,	P,	31.	Solid.	Amber.
		Arsenic,	As,	75.	"	Steel.
		Antimony (or stibium),	Sb,	122.	"	Bluish-white.
	Metallic.	Bismuth,	Bi,	210.	"	Reddish-white.
		Gold (or aurum),	Au,	196.	"	Yellow.
TETRADS.	*Non-Metallic.*	Carbon,	C,	12.	"	Black.
		Silicon,	Si,	28.	"	"
		Titanium,	Ti,	48.	"	Dark green.
		Tin (or stannum),	Sn,	118.	"	White.
	Metallic.	Platinum,	Pt,	197.	"	"

The remaining twenty-five of the sixty-four elements are of slight importance at present, and we will only mention them with their symbols and weights : —

Cadmium,	Cd,	111 6	Iridium,	Ir,	196.7	Ruthenium,	Ru,	103.5
Cæsium,	Cs,	133.	Lanthanum,	La,	139.	Tantalum,	Ta,	182.
Cerium,	Ce,	141.2	Molybdenum,	Mo,	95.6	Thallium,	Tl,	203.6
Didymium,	D,	147.	Niobium,	Nb,	94.	Thorium,	Th,	231.5
Erbium,	E,	169.	Osenium,	Os,	198.6	Tungsten (or Wolframium),	W,	184.
Gallium,	Ga,	69.8	Palladium,	Pd,	106.2	Uranium,	Ur,	240.
Glucinum,	Gl,	9.	Rhodium,	Rh,	104.1	Vanadium,	Va,	51.2
Indium,	In,	113.4	Rubidium,	Rb,	85.2	Yttrium,	Yt,	93.
			Zirconium,	Zr,	90.			

26. The atomic theory is the basis of the *new nomenclature* which in modern chemistry enables us to show by the symbols of compounds just how they are composed, and the relative weights and volumes of each substance in the compound.

Thus, we found by our analysis of water that there were two volumes of hydrogen to one of oxygen; and therefore we can express **water** by the symbol H_2O. But we see by the table, and we found by analysis, that oxygen weighs 8 times as much as hydrogen; and as *two* atoms of hydrogen are united with *one* of oxygen, the weight of the hydrogen in a molecule of water ought to be — as it is — 2, while the weight of the oxygen ought to be — as it is — 16.

The weight of a molecule of water, then, is $2 + 16 = 18$; of which $\frac{2}{18}$ or $\frac{1}{9}$ is H, and $\frac{16}{18}$ or $\frac{8}{9}$ is O.

If we wish to calculate how much O and H can be obtained from 10 pounds of H_2O, we have only to take $\frac{1}{9}$ of 10, or $1\frac{1}{9}$ lbs. for H, and $\frac{8}{9}$ of 10, or $8\frac{8}{9}$ lbs. for O.

We see by the table that **chlorine**, or Cl, is a *monad;* hence one atom of it will unite with one atom of H.

We will take, then, equal volumes of each, and mix them in a strong glass vessel and place it in the sunshine, and instantly an explosion takes place; and the result is HCl, chlorohydric, or hydrochloric-acid gas.

This symbol shows that one atom of H and one atom of Cl are united to form HCl; and the table shows that the Cl is 35.5 times the weight of the H. Hence, if there be 10 lbs. of HCl (a molecule of which weighs $1 + 35.5 = 36.5$), the weight of H in the HCl will be $\frac{1}{36\cdot5}$ of 10; and the weight of chlorine will be $\frac{85\cdot5}{36\cdot5}$ of 10.

We see, then, how much can be expressed by this *system* of *symbols*, or *nomenclature.*

27. HCl, H_2O, H_3N, and H_4C are the types upon which compounds in chemistry are based.

28. H_3N represents three atoms of hydrogen united to *one atom* of nitrogen, and is called *ammonia;* and H_4C represents four atoms of H united to one atom of carbon, and is called *marsh gas;* hence nitrogen is a triad, and carbon is a tetrad.

29. A **binary** is a compound which has only two kinds of atoms; as, HCl or SO_2 (sulphuryl, or sulphurous oxide).

In binaries the name is double, and the more *positive* substance comes first, changing its ending to *ous* or *ic;* while the *electro-negative* substance ends in *ide*. *Ous* usually represents the lower, and *ic* the higher equivalences.

Thus, in SO_2 (sulphur*ous* oxide), S represents four atoms of H; while in SO_3 (sulphur*ic* oxide) it represents six atoms of H.

Prefixes are used to express higher or lower equivalences; as, *di*, *hypo*, *per*, etc.

30. An **anhydride** is a substance which, by combining with water, can produce a *ternary*, called an acid.

31. A **ternary** is a compound of three substances or radicles. The first and third parts may be *monads;* but the second part must at least be a *dyad*, for it must present an equivalence for each of the parts united to it.

32. When an *acid* is a *binary*, as HCl, it is called a *haloid acid;* and when *binary salts* are formed, they are called *haloid salts*, as $NaCl$ (sodic chloride).

33. An **acid** is a salt of hydrogen, and is water, H_2O, with half its H replaced by a *negative radicle*, as HNO_3 (nitric acid), which is formed by taking one H atom from H_2O, and putting the *negative radicle* NO_2 in its place. It may be represented thus: —

$$\left.\begin{matrix}H\\H\end{matrix}\right\} O - H + NO_2 = \left.\begin{matrix}H\\NO_2\end{matrix}\right\} O, \text{ or } HNO_3.$$

If we burn sulphur in the air, we obtain SO_2 (sulphurous acid, or anhydride). If we take two atoms of H from two molecules of water, or $2H_2O$, and add SO_2, the result will be H_2SO_4 (sulphuric acid), represented thus: —

$$2H_2O = \left.\begin{matrix}H_2\\H_2\end{matrix}\right\} O_2 - H_2 + SO_2 = \left.\begin{matrix}H_2\\SO_2\end{matrix}\right\} O_2 = H_2SO_4.$$

Phosphorus burned in a limited portion of air produces P_2O_3 (phosphorous anhydride). "Anhydride" means without water or hydrogen.

Phosphorus burned in the open air gives P_2O_5 (phosphoric anhydride, or phosphoric oxide, a snow-white, inodorous powder). $P_2O_5 = \left.\begin{matrix}PO_2\\PO_2\end{matrix}\right\} O$. $H_2O - H + PO_2 = HPO_3$ (metaphosphoric acid). The result of throwing P_2O_5 into water will be two molecules of HPO_3. Thus: $H_2O + P_2O_5 = H_2P_2O_6 = 2(HPO_3)$.

$$P_2O_3 = \left.\begin{matrix}PO\\PO\end{matrix}\right\} O. \quad 3H_2O = \left.\begin{matrix}H_3\\H_3\end{matrix}\right\} O_3.$$

$$\left.\begin{matrix}H_3\\H_3\end{matrix}\right\} O_3 - H_3 + PO = H_3PO_4 \text{ (phosphoric acid).}$$

This is the result of throwing P_2O_5 into *hot* water, and the reaction will be $3H_2O + P_2O_5 = H_6P_2O_8 = 2(H_3PO_4)$.

If heat be applied to two molecules of phosphoric acid, $2(H_3PO_4)$, the reaction will be $H_6P_2O_8 - H_2O = H_4P_2O_7$ (pyro-phosphoric acid).

FIG. 4. — Phosphorus burning, and producing White Fumes.

HPO_3 is *monobasic;* that is, has one atom of replaceable H.
H_3PO_4 is *tribasic*, " " " three atoms " "
$H_4P_2O_7$ is *tetrabasic*, " " " four " " "

34. A **salt** is an acid with a part or the whole of its basic hydrogen replaced by *positive radicles*.

An *acid* salt is one in which the basic hydrogen is only partly replaced. Thus: —

Replace one atom of H in H_3PO_4 (phosphoric acid) by potassium or K, and the result will be KH_2PO_4, *an acid* salt.

Replace two atoms, and K_2HPO_4, *a basic* salt, results.

Replace all the H, and K_3PO_4, *a normal* salt (potassic phosphate) is produced.

Whenever a normal salt is formed from an *ic* acid, its name ends in *ate;* and when formed from an *ous* acid, its name ends in *ite*. Thus: —

Ferrous sulph*ate*, $FeSO_4$ is formed from H_2SO_4 (sulphur*ic* acid); and $FeSO_3$ ferrous sulph*ite*, is formed from H_2SO_3 (sulphur*ous* acid).

We have shown how acids and salts are obtained from the water type, H_2O, and the system of symbols applied to them, or their nomenclature.

35. It now remains to show how compounds are formed upon the types of ammonia NH_3, and marsh gas H_4C, or CH_4.

36. When *ammonia gas* (NH_3) is dissolved in H_2O, it may be considered as compounded with it, and the result will be *liquid ammonia* (NH_5O). When ammonia water is mixed with nitric acid, the reaction which takes place is similar to that which occurs when nitric acid (HNO_3) is mixed with a solution of caustic potash (KHO). The salt formed is called *ammonic nitrate;* and, in order that its analogy to caustic potash may be exhibited, the formula NH_5O is written $(NH_4)\ HO$; NH_4 taking the place of K in the water type: and we may suppose that in each case the reaction was as follows:—

$\left.\begin{matrix}H\\H\end{matrix}\right\}O - H + NH_4 = \left.\begin{matrix}NH_4\\H\end{matrix}\right\}O$ or $(NH_4)\ HO$ (ammonia water); and $\left.\begin{matrix}H\\H\end{matrix}\right\}O - H + K = \left.\begin{matrix}H\\K\end{matrix}\right\}O$ or KHO (caustic potash).

The reaction which takes place by the mixing of $(NH_4)\ HO$ with HNO_3 (nitric acid) may be represented as follows:—

$(NH_4)\ HO + HNO_3 = (NH_4)\ NO_3$ (ammonic nitrate) $+ H_2O$ (water), just as $KHO + HNO_3 = KNO_3$ (potassic nitrate) $+ H_2O$.

On the same principle may be formed ammonic chloride. Thus:—

NH_3	+	HCl	=	NH_4Cl.
Ammonia gas.		Hydrochloric acid.		Ammonic chloride.

37. In the **marsh gas, or methyl hydride (CH_4) series,** carbon atoms regularly increase by *one*, and the hydrogen atoms regularly increase by *two*, and may be regarded as *hydrides* of radicles as follows:—

Radicles.									
Methyl	CH_3	+	H	=	Methyl	Hydride	or	Methane	CH_4.
Ethyl	C_2H_5	+	H	=	Ethyl	"	"	Ethane	C_2H_6.
Propyl	C_3H_7	+	H	=	Propyl	"	"	Propane	C_3H_8.
Butyl	C_4H_9	+	H	=	Butyl	"	"	Butane	C_4H_{10}.
Amyl	C_5H_{11}	+	H	=	Amyl	"	"	Pentane	C_5H_{12}.
Hexyl	C_6H_{13}	+	H	=	Hexyl	"	"	Hexane	C_6H_{14}.
Heptyl	C_7H_{15}	+	H	=	Heptyl	"	"	Heptane	C_7H_{16}.
Octyl	C_8H_{17}	+	H	=	Octyl	"	"	Octane	C_8H_{18}.
Nonyl	C_9H_{19}	+	H	=	Nonyl	"	"	Nonane	C_9H_{20}.

The first two in this series are gases; and the others are liquids of varying densities, and having boiling points which increase about thirty degrees each in the order named; propane boiling at 30° and nonane at 150° Fahr.

38. **Alcohols** are formed by the substitution of the above *radicles* in the water type. Thus:—

$\left.\begin{matrix}CH_3\\H\end{matrix}\right\}O$ or CH_4O is methylic alcohol; $\left.\begin{matrix}C_2H_5\\H\end{matrix}\right\}O$ or C_2H_6O is ethylic alcohol; and so on. Each differs from the other by CH_2. *Ethylic* alcohol (C_2H_6O) is the ordinary alcohol produced by grape and vegetable fermentation.

It is a colorless, volatile, and inflammable liquid, and mixes with water in any proportion. It is called *absolute alcohol.*

39. The **hydrides** above mentioned occur in the coal-oils; and Pennsylvania petroleum is chiefly a mixture of these hydrocarbons.

40. The **ethers** are formed by replacing *both* hydrogen atoms of water with these *radicles.* Thus:—

$\left.\begin{matrix}H\\H\end{matrix}\right\}O - H_2 + \left.\begin{matrix}C_2H_5\\C_2H_5\end{matrix}\right\} = (C_2H_5)_2\ O$, or *ordinary ether.*

It may be produced by mixing equal volumes of ordinary alcohol (C_2H_6O) and sulphuric acid (H_2SO_4), and slowly heating the mixture.

41. An **aldehyde** is an alcohol with two hydrogen atoms displaced; and by oxidation it becomes an acid. Thus:—

$$C_2H_6O + O = \left.\begin{matrix}C_2H_3\\H\end{matrix}\right\} O \text{ (aldehyde)} + H_2O \text{ (water)}.$$

$$\left.\begin{matrix}C_2H_3\\H\end{matrix}\right\} O \text{ or } \underset{\text{aldehyde}}{C_2H_4O} + O = C_2H_4O_2 \text{ (acetic acid)}.$$

The alcoholic liquid formed by grape fermentation, by influence of the oxygen of the air, changes into acetic acid. Vinegar is a very dilute solution of this acid.

Acetic acid is one of the fatty acid series.

42. C_2H_4, C_3H_6, etc., when introduced into the water type, produce the *glycols*.

This is called the *ethylene* or *olefiant gas* series of alcohols, because olefiant gas (C_2H_4) is the first of the series.

43. The **glycols** have two series of acids, called the *lactic* and the *oxalic*.

44. *Lactic acid* ($C_3H_6O_3$) is the result of the fermentation of the sugar of milk, or milk-sugar ($C_{12}H_{22}O_{11}$).

45. *Oxalic acid* ($C_2H_2O_4$) is found in nature in rhubarb and sorrel, and is formed by sawdust, wood-fibre, starch, etc., with KHO. It also occurs in water crystals, having the formula $C_2H_2O_4 + 2H_2O$. It is poisonous. *Chalk is an antidote.*

46. *Malic acid* ($C_4H_6O_5$) occurs in unripe apples, and most acid fruits.

47. *Tartaric acid* ($C_4H_6O_6$) occurs in many plants, and is obtained in large quantities from the grape. The *bitartrate of potash*, which is deposited on the inside of casks, during wine fermentation, when purified is called *cream of tartar.*

48. *Citric acid* ($C_6H_8O_7$) and *tannic acid* ($C_{27}H_{22}O_{17}$) are others of the oxalic series.

49. **Alkalies** are metallic oxides readily soluble in water; have a soapy taste; turn red litmus paper to blue; and neutralize acids, restoring the colors changed by them. *Potassic hydrate* (KHO), heretofore mentioned as "caustic potash," and *sodium hydrate* ($NaHO$), are alkalies.

50. Having now sufficiently described the methods of formation of the various kinds of chemical compounds, and given a comprehensive system of symbols or nomenclature, we may consider more particularly the *elements* of nature, and their principal compounds.

HYDROGEN.

51. We have already seen that hydrogen enters into all the acids, most of the alkalies, and forms two thirds in volume of all the water on the earth. It has neither taste nor odor nor color; and, though animals would die if immersed in it, yet it is not poisonous, but in its free state is, like nitrogen, inert. While we could not live by breathing it, we could not live without it in combination. It is the lightest substance known, and possesses the power of diffusion in the highest degree. It is exceedingly inflammable in the presence of oxygen, but will instantly extinguish the flame of a body immersed in it, because oxygen is necessary for combustion. Its own combustion always produces watery vapor, which at once condenses when brought in contact with cold bodies.

When analyzing water by dropping potassium and sodium on it, we found hydrogen set free, but wondered what became of the metal. We can now understand the reaction that took place. $K_2 + 2H_2O = 2KHO + H_2$.

KHO (potassic hydrate) is formed and dissolved in the water. H_2 burns.

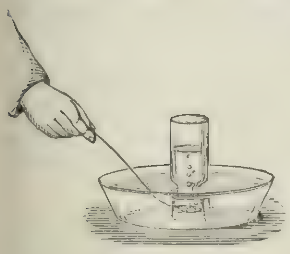


Fig. 5.

$Na_2 + 2H_2O = 2NaHO + H_2$. H_2 escapes, as shown in Fig. 5, and is collected in the receiver, while the sodic hydrate ($NaHO$) dissolves in the water.

Zinc liberates hydrogen from sulphuric acid (H_2SO_4.)

The reaction is, $Zn + H_2SO_4 = ZnSO_4$ (zinc sulphate) $+ H_2$.

FLUORINE.

52. **Fluorine** is a *monad*, because it unites with hydrogen atom for atom, thus forming *fluo-hydric acid* (HFl), which is its usual commercial form. Its common form in nature is *fluor-spar*,—a mineral in crystalline form whose chemical name is *calcic fluoride* ($CaFl_2$).

Little is yet known of the element *fluorine;* but the acid (HFl) is used for etching glass. The reaction on glass is, SiO_2 (*silicon di-oxide*) $+ 4HFl = SiFl_4$ (*silicic fluoride*, a gas) $+ 2H_2O$.

CHLORINE.

53. **Chlorine** is abundant and generally distributed, but is not found free in nature. Its most natural state is *sodic chloride* ($NaCl$), the *salt* of commerce. It exists in solid deposits in the form of rock-salt, in solution in sea-water and salt lakes, and in mineral springs.

This is one of the most useful combinations of elements.

Chlorine, when set free, is a gas, of greenish color, irritating to flesh, and destructive of life when breathed. It is a powerful chemical agent, and is extensively used for *bleaching* purposes, especially in whitening cotton and linen goods. The dry gas will not bleach, but it must be in solution with water, or in form of *bleaching powder* ($CaCl_2O_2 + CaCl_2$).

In one glass vessel (Fig. 6) put dilute sulphuric acid, and in another put the bleaching powder and water. Dip a piece of calico successively in each solution several times, and then wash it in a basin of water.

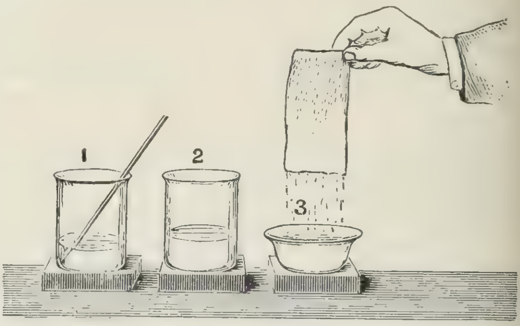


FIG. 6. — Bleaching by Chlorine (Bleaching Powder).

The sulphuric acid will set chlorine free from the powder solution, and the chlorine will destroy the color of the cloth. The reaction will be as follows: —

$$(CaCl_2O_2+CaCl_2)+2H_2SO_4=2Cl_2+2CaSO_4+2H_2O.$$

Bleaching powder.	Sulphuric acid.	Chlorine.	Calcium sulphate.	Water.

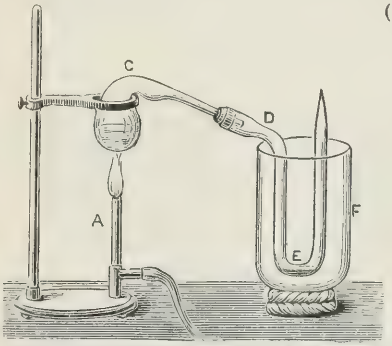


FIG. 7. — Hydrochloric Acid obtained by heating Common Salt mixed with Sulphuric Acid.

54. *To obtain hydrochloric acid,* mix with *common salt* ($NaCl$) in a small retort (Fig. 7), enough sulphuric acid to make a thin paste, B; connect the mouth of the retort with a receiver by a tube, D, containing a few drops of water; heat the retort gradually, and HCl will condense in the receiver at E. The reaction will be: —

$NaCl + H_2SO_4 = HNaSO_4$ (hydro-sodic sulphate) $+ HCl$.

55. Either hydrochloric acid or common salt will precipitate *argentic chloride* ($AgCl$) when mixed with a solution of *argentic nitrate* ($AgNO_3$). The reactions will be as follows: —

$HCl + AgNO_3 = HNO_3 + AgCl$, or $NaCl + AgNO_3 = NaNO_3 + AgCl$.

56. **Argentic chloride** is used in photography for preparing the surface of paper for the action of sunlight.

BROMINE.

57. **Bromine** is also a monad, and, though never found "free," exists as a *bromide* of metals in sea-water and salt springs. It is chiefly used in the arts as *bromide of potassium* (KBr).

Bromine is a liquid of a dark brownish-red color, and is three times as heavy as water. It is poisonous, and has a disagreeable odor, on account of which it received its name. It closely resembles chlorine in chemical action.

IODINE.

58. **Iodine,** like bromine, occurs as an *ide* of certain metals in salt water, but is rare in nature and never found free. It is known in commerce as *iodine,* and as *iodide of potassium* or *potassic iodide* (KI).

59. *Iodine* is extracted from marine plants, which absorb it from sea-water. Its odor is similar to, but less pungent than, that of chlorine. It does not dissolve readily in water, but quickly forms a solution with alcohol. Its vapor is of a beautiful purple color, from which it derives its name. At ordinary temperatures it is a soft, crystalline solid, of a dark-blue color, and has a specific gravity of 4.95. It forms a blue compound with starch, and this is its best test. Iodine gradually corrodes animal tissues, and, with some of its compounds, is used in medicine and photography.

60. Like *chlorine* and *bromine*, it unites with hydrogen atom to atom, and forms *hydro-iodic* or *iodohydric acid* (HI).

61. The four monads, **fluorine, chlorine, bromine,** and **iodine,** exhibit characteristics remarkable for their similarity, but have chemical activity inversely as their atomic weights; that is, the greater the atomic weight, the less readily do they combine with other elements.

SILVER.

62. **Silver** is a metallic element, and exists in an uncombined, as well as combined, state in nature.

63. Chemically considered, it combines most readily with nitric acid (HNO_3) to form $AgNO_3$ (*argentic nitrate*), which is used as a re-agent in producing argentic chloride ($AgCl$). Place $AgCl$ on charcoal with potassic carbonate (K_2CO_3), and fuse the mixture, and pure silver will be liberated.

Argentic nitrate ($AgNO_3$) is sold in small sticks as *lunar caustic*, which is used for cauterizing flesh.

POTASSIUM.

64. **Potassium** or **Kalium** exists in many minerals, but is very hard to obtain in a pure state on account of its strong affinity for oxygen. It can only be kept "free" under oil containing no oxygen. A common source of it is wood-ashes. It is a silver-white substance, brittle at 0° Fahr., soft at ordinary temperatures, and is volatilized at a red heat. It is lighter than water, and quickly oxidized by air and water. Decomposing granitic rocks contain portions of potassium silicate; hence the greater portion of the earths resulting from rock sediment contain this constituent of plant food. The salt obtained from the ashes of plants is called *potash*, and from it are obtained the potassium compounds

65. **Potassic carbonate** (K_2CO_3) was the greatest alkali source until it was found that soda could be more cheaply produced.

66. **Hydro-potassic carbonate** ($HKCO_3$) is **Saleratus,** — sometimes called *bicarbonate of potash*, — and is prepared by passing carbon di-oxide (CO_2) through a strong solution of potassic carbonate.

67. **Potassic nitrate** (KNO_3), formed by replacing the H of nitric acid by K, is commonly known as *saltpetre* or *nitre*, and is widely distributed in nature. It is found in caves, as the Mammoth Cave, Kentucky; but the chief commercial source is the soil of tropical regions, and especially in Arabia and India.

Its natural production appears to result from the putrefaction of vegetable and animal matter in connection with air and alkaline bases capable of fixing the nitric acid when formed. It is white, inodorous, and has a bitter taste. Its chief use is in the manufacture of gunpowder.

68. **Gunpowder** is a mechanical mixture of soft-wood charcoal, sulphur, and potassium nitrate, in the ratio of 70 or 80 per cent of the nitrate to 10 or 12 per cent of each of the other ingredients.

69. **Potassic hydrate** (KHO) is manufactured from potassic carbonate, exactly as caustic soda ($NaHO$) is prepared from sodic carbonate ($NaCO_3$), and is used by physicians for cauterizing purposes.

70. **Potassic chlorate** ($KClO_3$) is a powerful oxidizing agent, and is much used in the manufacture of matches, fireworks, and in calico-printing and medicines.

71. **Potassic chloride** (KCl) is formed by applying heat to $KClO_3$, and the result is $KCl + 3O$.

72. **Potassic bromide** (KBr) and **potassic iodide** (KI) resemble the *chloride*, and are used medicinally, as heretofore mentioned.

73. **Potassic cyanide** (KCN) is a white, fusible solid made by fusing nitrogenous organic matter with potassic carbonate. It is used in gilding and silvering by electricity, because gold and silver cyanides are soluble in it. It is very poisonous.

74. **Potassic ferrocyanide** (K_4FeCy_6) results when **KCN** is formed in the presence of iron filings. It crystallizes in large, yellow crystals, and is known in commerce as *yellow prussiate of potash.*

75. **Potassic sulphate** (K_2SO_4) enters into composition with the double sulphates to form *alums.*

SODIUM.

76. **Sodium or natrium** has much the appearance of potassium, and has to be treated in the same manner to keep it in a "free" state.

77. **Sodic hydrate** ($NaHO$) — *caustic soda* — is made from sodic carbonate (Na_2CO_3) by dissolving it in boiling water and pouring into it slaked lime mixed with water. The reaction is, $Na_2CO_3 + CaH_2O_2 = 2NaHO + CaCO_3$.

The calcic carbonate ($CaCO_3$) is a white, insoluble precipitate, hence can easily be separated from the solution of ($NaHO$) sodic hydrate, which may be evaporated until it reaches the desired state of consistency. This *caustic soda* is used in great quantities by soap-makers.

78. **Hydro-sodic carbonate** ($HNaCO_3$) is analogous to $HKCO_3$, and is called in commerce *bicarbonate of soda.* It is one of the ingredients in most of the artificial yeasts, and is commonly known as **Soda.**

79. **Sodic carbonate** (Na_2CO_3) is very largely manufactured, and used in making glass and soap, in washing, and in preparation of compounds. It is now generally made by Leblanc's process from common salt.

80. **Sodic biborate or Borax** ($Na_2B_4O_7,10H_2O$) is a colorless, crystalline salt, occurring naturally; but the greater part is made from the native boracic acid of Tuscany by the addition of sodic carbonate.

81. **Sodic chloride** — common salt ($NaCl$) — has already been sufficiently described under "Chlorine."

82. When **Sodic sulphate** (Na_2SO_4) is made and dissolved in water at 30°, upon cooling, large, colorless crystals, bitter and cooling to taste, are formed, known as **Glauber's Salts.**

LITHIUM.

83. **Lithium** (Li) is rare both in nature and in the arts. It forms a small percentage of mica and feldspar, of sea and mineral waters; and minute traces are found in milk, tobacco, and blood. It is the lightest of known solids, its specific gravity being only .59. The *volatile lithium compounds* color gas, alcohol, or blow-pipe flame carmine-red. In many substances its presence has only been detected by *spectrum analysis.*

OXYGEN.

84. **Oxygen,** by our analysis, was found to be a *dyad,* to form eight parts, by weight, of water, and one fifth of the atmosphere by volume. It is the most abundant *element,* and constitutes by weight one half of the whole earth. Life could not exist without it, and yet by it life is finally destroyed. It supports combustion, and gradually oxidizes most substances with which it comes in contact, — that is, forms a chemical union with them.

85. Sulphur burns in oxygen with a brilliant violet flame, and forms a suffocating gas SO_2 (*sulphurous di-oxide*). Charcoal burns in it rapidly, producing *carbon di-oxide* (CO_2). Iron burns in it, forming magnetic, or ferroso-ferric, oxide (Fe_3O_4).

86. The products of this burning or chemical union, called **oxidation,** are numerous and varied, and include the rust of metals, ashes, putrefaction, red blood, water, most acids and salts, animal and vegetable matter, and the varieties of silica, — as sand, quartz, flint, — as well as the limestones and feldspars. Its office is to build up anew from the old material which it removes, and thus keep all nature fresh and beautiful. We necessarily consider its compounds as we speak of the other elements.

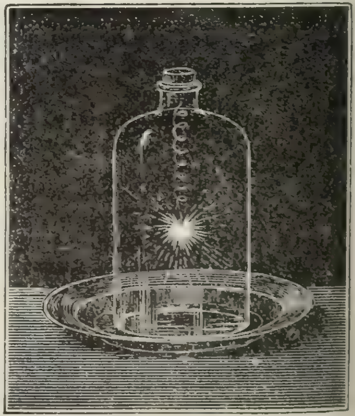


FIG. 8. — Sulphur burning in Oxygen.

SULPHUR.

87. **Sulphur** is found *native*, as well as in combination with metals. It has extensive use in the arts, as well as for many common purposes. Native sulphur is chiefly found in the region of volcanoes, and frequently in well-defined crystals. Fully nine tenths of the sulphur of commerce comes from Sicily. Pure sulphur has neither taste nor smell when in a solid state, unless rubbed, when it yields a faint, peculiar odor. The odors usually attributed to sulphur come from its compounds.

88. It is one of the elements which undergo changes in appearance and general qualities while retaining their chemical identity, hence called *allotropic*.

Sulphur, when melted at 115° Fahrenheit, forms a clear liquid of a light-yellow color; but, if a greater heat be applied, it will become almost black at 200°, and will stick to the inverted vessel. At 340° it regains its fluidity, and at 440° boils and is changed into an amber-colored vapor. If, just before it begins to boil, it be suddenly cooled, a semi-solid appearance, greatly differing from the ordinary form, will result. This *soft sulphur*, however, slowly hardens into its ordinary brittle form.

If allowed to cool slowly, after being just sufficiently heated to melt, until the surface has hardened and half the mass solidified, and then the top crust be broken and the unhardened portion poured off, the interior will be found lined with fine *transparent crystals* (Fig. 9).

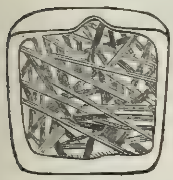


FIG. 9. — Crystals of Sulphur.

89. Most of the elements combine with sulphur readily, in some cases producing light. The suffocating gas produced when sulphur burns in open air is termed *sulphurous anhydride* (SO_2), and is sometimes called "sulphurous acid," though, strictly, "*sulphurous acid*" is H_2SO_3.

SO_2 is more easily obtained by heating metallic copper (Cu) with sulphuric acid (H_2SO_4); and the reaction is, $Cu + 2H_2SO_4 = CuSO_4 + 2H_2O + SO_2$.

This gas can be readily obtained in a liquid state by passing the gas through a U-shaped tube immersed in a freezing mixture of salt and ice. The liquid thus produced evaporates with great rapidity at ordinary temperatures. SO_2 is extensively used in bleaching vegetable colors, especially in case of straw, wool, silk, etc., which would be injured by chlorine.

90. The **bleaching** may be effected by immersing the article in SO_2 liquid, or by exposing the moistened articles to the fumes of burning sulphur (Fig. 10).

This gas seems to combine with the colors to produce colorless compounds, instead of destroying the coloring matter as chlorine does; for in most cases the colors can be reproduced by the action of chemical agents which will set free SO_2.

If a red flower, which has been bleached by SO_2 fumes, be dipped in *dilute sulphuric acid* (H_2SO_4), dried and warmed, its color will reappear. The best method of bleaching now is in using SO_2 condensed into a liquid; for, on being released, it passes very rapidly into gas and through the closest fabrics, and without injuring the most delicate silk fibre.

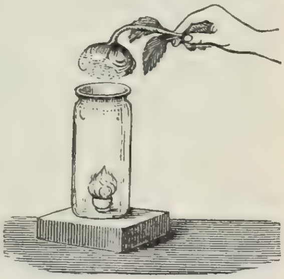


FIG. 10. — Bleaching by Sulphur Fumes.

91. **Sulphuric anhydride** (SO_3) may be prepared by passing $SO_2 + O$ over hot platinum wire finely divided, SO_3, condensing in the cold receiver. It is a white, wax-like solid, and crystallizes in silky fibres. When thrown on water, chemical union takes place with a hissing noise and an evolution of heat, and the result is *sulphuric acid* (H_2SO_4).

92. **Sulphuric acid** is the most important of all chemical manufactures, for by its use the chemist either directly or indirectly produces nearly every other important chemical product.

Its manufacture is so extensive that we will describe the method. The principle is in forcing a compound, which readily parts with oxygen, to yield it to one that has strong affinity for it, as HNO_3 to SO_2. The reaction is, $2HNO_3 + SO_2 = 2NO_2 + H_2SO_4$.

In properly constructed furnaces, A, A (Fig. 11), crude sulphur, or a compound called *iron pyrites* (FeS_2), is burned; and the resulting gas, with a large quantity of air, is allowed to pass (through the leaden drum B, B) into the first of a series of large sheet-lead chambers, C, D, E, into which are forced steam and nitrous fumes by decomposing sodium nitrate heated in an iron pot with H_2SO_4, or supplied as in figure by the drum, H. The SO_2 in contact with the steam abstracts oxygen from the nitrous fumes, and forms SO_3, which at once unites with the watery vapor to form H_2SO_4, and this condenses upon the sides of the chamber and runs down to the floor. The NO resulting from the above reaction unites with the excess of oxygen in the chamber to form NO_2, which immediately unites with a new portion of SO_2 as it flows on through other chambers, and so the process continues until SO_2 is all changed to H_2SO_4, and only NO passes from the last chamber. The sulphuric acid, greatly diluted by excess of water, and containing a certain quantity of plumbic sulphate ($PbSO_4$) in solution formed by the action of H_2SO_4 on the walls of the leaden chambers, is now drawn off into vessels. In a short time the $PbSO_4$ separates from the acid, and settles as a white sediment. The dilute H_2SO_4 is now poured into platinum vessels having their joints soldered with gold, — as no other solder will withstand the action of hot sulphuric acid in concentrated form, — and the excess of water evaporated until only 7 per cent of water remains, while 93 per cent is H_2SO_4 (*concentrated sulphuric acid, or "oil of vitriol"*). Every 100 pounds of sulphur yields 310 pounds of acid; hence the gain in weight must be in oxygen and hydrogen taken from the excess of air and water in the chambers.

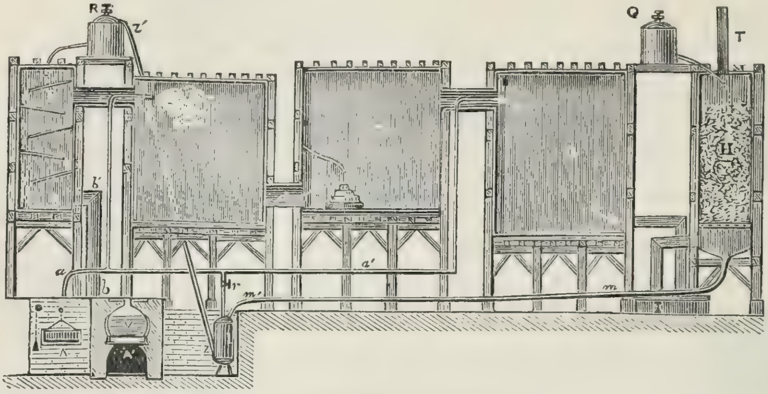


FIG. 1.. — Manufacture of Sulphuric Acid.

93. *Sulphuric acid* was first manufactured by distilling ferrous sulphate — formerly called "*green vitriol*" — in earthen retorts; hence the name "*oil of vitriol.*"

Concentrated sulphuric acid chars, or reduces to carbon, *sugar* ($C_{12}H_{22}O_{11}$), *starch* ($C_6H_{10}O_5$), and *paper;* dissolves *indigo* ($C_{16}H_{10}N_2O_2$); and evolves heat when mixed with water (H_2O).

94. **Hydrogen sulphide** or **di-hydric sulphide** (H_2S), commonly called *sulphuretted hydrogen,* is a colorless, poisonous gas, with a most disagreeable odor. It is prepared by the action of hydrochloric acid (HCl) on ferric sulphide (FeS). The reaction is, $FeS + 2HCl = FeCl_2 + H_2S$. It burns with a blue flame, producing H_2O and SO_2. When in a solution with water, it is used as a chemical re agent. It is always found wherever animal matter is putrefying.

95. When the hydrogen of H_2SO_4 is replaced by metals, the resulting salts are called **sulphates,** as, Na_2SO_4, *sodic sulphate;* $CaSO_4$, *calcic sulphate.*

The other non-metallic dyads are so rare, and of so little importance generally, that it is not necessary to describe them.

LEAD.

96. **Lead** is one of the most important metallic dyads, but its greatest commercial value is as a metal (Pb), and we need not consider it at length as a chemical compound. It is generally obtained from its principal natural compound, *galena* (PbS), whose chemical name is **plumbic sulphide.** It is extensively used as lead pipe. It should not, however, be used as pipe to convey water for drinking purposes, because the action of air and water upon it results in a very poisonous salt, which with CO_2 becomes *plumbic carbonate* ($PbCO_3$).

97. Its most important chemical compound is a **hydrated plumbic carbonate,** commonly called **white lead** ($PbCO_3HO$).

98. **Plumbic Protoxide** (PbO) is one of the compounds produced in the course of smelting, and is commonly called **litharge.** It is used as a pigment, and in the manufacture of glass, and by the metallurgist to form fusible compounds with metallic oxides.

H_2S is a test for lead, and produces with it a black precipitate of plumbic sulphide (PbS).

BARIUM AND STRONTIUM.

99. **Barium** is most abundant in the form of a mineral spar, called in chemistry **baric sulphate** ($BaSO_4$).

100. **Baric Chloride** ($BaCl_2$) and **baric nitrate** ($Ba(NO_3)_2$) are used to some extent in the arts, and in pyrotechny to produce green flame. $BaCl_2$ and H_2SO_4 are tests for each other.

101. **Strontium** resembles barium in chemical action, and is used in pyrotechny to produce red flame.

CALCIUM.

102. **Calcium** enters into the composition of many of the most important compounds. It is white, with a yellow tinge, is ductile, oxidizes rapidly in contact with water, and sets hydrogen free, and at a red heat in the presence of oxygen it burns with a bright light. It is widely distributed, and abundant in the forms of limestone, chalk, marble, calcspar, shells, etc. All these occur in nature as **calcic carbonate** ($CaCO_3$).

103. When subject to a red heat, $CaCO_3$ gives off carbon di-oxide (CO_2), and is resolved into (CaO), **calcic oxide,** generally called **quick-lime.** Calcic oxide is not further affected by heat; hence is used for making crucibles; but, when brought in contact with water, it unites with it with great heat evolution, and forms **calcic hydrate** (CaH_2O_2), commonly known as **slaked lime.**

104. **Lime** is used for the purification of coal-gas; for the manufacture of soda and potash, ammonia water, and bleaching powders; in refining sugar, etc

105. **Calcic sulphate** ($CaSO_4$), when hydrated, becomes the mineral gypsum ($CaSO_4 + 2H_2O$).

106. **Gypsum,** when gradually heated, becomes **Plaster of Paris.**

107. **Calcic chloride** ($CaCl_2$) may be prepared by dissolving chalk or marble in HCl and drying the solution. The reaction is, $CaCO_3 + 2HCl = H_2O + CO_2 + CaCl_2$. It dissolves readily in water.

108. **Calcic phosphate** ($Ca_3P_2O_8$) is the most important of the phosphates, and is commonly called bone-phosphate. It is a valuable manure, and is the chief ingredient of some kinds of guano. When treated with H_2SO_4, a soluble *hydro-calcic phosphate* ($H_4CaP_2O_8$), commonly called **superphosphate of lime,** is formed.

MERCURY.

109. **Mercury** is found *native* and as *cinnabar* (HgS), mercuric sulphide. **Vermilion** is an artificial compound used as a pigment, and has the same composition as cinnabar, HgS. Mercury (Hg) is used for the extraction of gold and silver from ores, also for medicinal purposes, and for forming amalgams, etc. **Cinnabar** is the chief ore of mercury. **Red oxide** of mercury is HgO.

110. **Calomel** is **mercurous chloride** (Hg_2Cl_2), and is a tasteless, odorless, white powder, frequently used as a medicine.

111. **Mercuric chloride** ($HgCl_2$), generally known as "*corrosive sublimate,*" commonly appears in form of crystals, and it is very poisonous. *Albumen,* in the form of the raw white of egg, *is an antidote for the poison.*

COPPER.

112. **Copper** occurs in nature in many compounds, and pure. **Copper pyrites** (Cu_2S,Fe_2S_3) is the principal ore.

113. **Cupric sulphate** ($CuSO_4$) is most used in the arts, and is generally known as **blue vitriol.** It is used in dyeing.

114. **Cupric oxide** (CuO) is the black coating which collects on copper or brass, and is very poisonous.

115. The acetates of copper are formed by the action of acetic acid on copper, and are commonly called *verdigris.*

116. Metallic copper is a good conductor of heat and electricity, is precipitated by metallic iron, and dissolves in H_2SO_4. Ammonic hydrate (NH_4HO) is a test for copper, producing a deep-blue solution with cupric sulphate.

MAGNESIUM.

117. **Magnesium** is a white metal which readily dissolves in acids, and burns with a bluish-white light of great actinic power; hence is used in photography, in illuminating places where sunlight does not penetrate.

118. The *hydrated* compound of *magnesium sulphate,* known as **Epsom salts** ($MgSO_4 + 7H_2O$), is much used in medicine.

ZINC.

Zinc does not occur in the metallic state in nature, but is found in many different ores. The uses of zinc are so well known that it is not necessary to mention them.

Zinc is obtained by heating the *red oxide,* or ZnO, with carbon (C). The reaction is, $ZnO + C = Zn + CO$. The CO escapes, while the zinc (Zn) condenses.

119. **Zinc sulphate** ($ZnSO_4$), *white vitriol,* is used in medicine.

IRON.

120. **Iron** is usually found as an oxide or a sulphide. *Iron pyrites* (FeS_2) cannot be economically used for the manufacture of iron.

121. **Ferric oxide** (Fe_2O_3) occurs abundantly in nature as *hematite, specular iron,* and *red ochre,* and is a valuable ore. This is sometimes called the *sesquioxide,* also the *red oxide,* of iron.

122. The **magnetic oxide** of iron (Fe_3O_4) is one of the best ores of iron.

123. **Ferric hydrate** ($Fe_3H_6O_6$) may be produced by adding an excess of ammonia water to the solution of a ferric salt. *Yellow ochre* is a variety of ferric hydrate.

124. **Prussian blue** ($Fe_7C_{18}N_{18} + 18H_2O$) is a compound of ferric and ferrous cyanides.

125. **Iron protosulphide,** or **ferric sulphide** (FeS), is of value to the chemist, because it is the cheapest source of H_2S, which is an important re-agent.

MANGANESE.

126. The most useful form of manganese is MnO_2, **manganese di-oxide.** It is used in the arts as **manganous sulphate** ($MnSO_4$) and **potassic permanganate** ($K_2Mn_2O_8$). These give a purple color to borax glass.

Manganese is a grayish-white, brittle metal.

ALUMINUM.

127. **Aluminum** is one of the most abundant *elements,* and forms one twelfth of the solid matter of the earth.

It occurs especially in combination with oxygen and silicon, but it is obtained pure with difficulty; hence it is not in common use as a metal.

It is light, malleable, ductile, and, as an alloy of copper, as tenacious as steel.

128. **Aluminic oxide,** or **Alumina** (Al_2O_3), occurs as the minerals corundum, ruby, and sapphire.

129. **Aluminic hydrate** ($Al_2H_6O_6$) combines readily with many organic coloring matters to form compounds insoluble in water.

130. **Aluminic sulphate,** $Al_2(SO_4)_3$, is obtained by a union of sulphuric acid with hot clay, aluminium silicate, and then adding water, which dissolves the sulphate and leaves the silica.

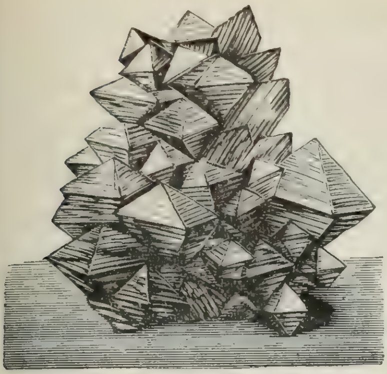


Fig. 12.—Alum Crystals.

131. **Common alum,** $Al_2K_2(SO_4)_4 + 24H_2O$, is an *aluminic potassic sulphate*, combining in well-defined crystals.

To some extent, *ammonium* has of late taken the place of *potassium* in forming *alum.*

The *aluminum silicates* are the most important compounds of this metal, including all kinds of pottery, porcelain, and every kind of clay formation.

132. **Cobalt** is only used in its compounds to give a blue color to glass.

133. **Nickel** is used in metallic form in coinage, and nickel-plating.

134. **Chromium** is only used in its compounds for coloring purposes.

NITROGEN.

135. In addition to what has already been said concerning *nitrogen*, it will only be necessary to refer to some of its compounds.

Ammonic hydrate (NH_4,HO) is commonly called *spirits of hartshorn.* If this be shaken in a bottle, *ammonia gas* (NH_3) will be released, and, if in escaping it come in contact with hydrochloric acid (HCl), it will form white fumes of **ammonic chloride** (NH_4Cl).

All ammonium salts are volatile.

136. Nitric acid (HNO_3) is found in nature combined with sodium or potassium, and is obtained by adding H_2SO_4 to one of the nitrates. If *sodium nitrate* ($NaNO_3$) be heated in a retort (A, Fig. 13), with H_2SO_4, the Na will be replaced by H, thus forming HNO_3. The reaction is, $NaNO_3 + H_2SO_4 = HNaSO_4 + HNO_3$. The acid will pass over in form of vapor, and become condensed in the receiver B by the external application of cold water, through the tube *f*, to the network covering of the receiver in the trough, C C.

137. If NH_4 be substituted in place of Na, the result will be (NH_4,NO_3), **ammonic nitrate**. If this nitrate be heated in an evolution flask, and the volatilized product be conveyed through a tube beneath a vessel over water, the gas thus collected will be N_2O (**nitrous oxide**, or **nitrogen protoxide**), commonly called "**laughing gas.**" The reaction is $(NH_4)\ NO_3$ heated $= 2H_2O + N_2O$.

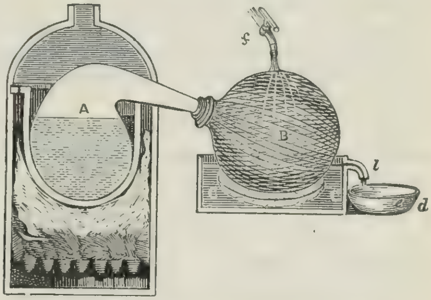


Fig. 13.—Preparation of Nitric Acid.

It is used as an anæsthetic in cases where insensibility is desired for only a very short time.

138. **Nitric oxide** (NO), or N_2O_2, or $(NO)_2$ is formed by the action of nitric acid on copper. This gas readily absorbs *oxygen* from the air, and forms the brown fumes of **nitrogen tetroxide** (N_2O_4 or NO_2).

139. **Sal ammoniac** (NH_4Cl) is *ammonic chloride*, and is prepared from the ammoniacal liquor of gas-works by treating it with HCl. The reaction is, $NH_3 + HCl = NH_4Cl$.

140. **Nitre**, or **saltpetre**, or **potassic nitrate** (KNO_3), is prepared by making beds of animal remains covered with alkaline earth. The resulting decomposition produces NH_3, which, in its passage through the earth, yields its H and unites with oxygen, forming (N_2O_5), *nitric anhydride.* This anhydride has NO_2 replaced by K, and the result is KNO_3.

PHOSPHORUS.

141. **Phosphorus** is always found in compound form, and the most common combination is **calcium phosphate**, $Ca_3(PO_4)_2$, which occurs as a native mineral, *apatite*, and as the chief mineral constituent of the bones of animals. When pure, phosphorus is a colorless, wax-like solid.

142. It unites with oxygen readily, and on exposure to the air develops **ozone** (O_3), which is an allotropic form of oxygen, — an irritating, poisonous gas, exhibiting many of the characteristics of chlorine, and called *ozone* on account of its disagreeable odor.

Only chemical analysis shows that it is three atoms of oxygen condensed into one molecule, forming a gas totally different from O_2, or free oxygen, in its general properties.

143. When phosphorus is heated in a vacuum to 230° Fahr., it is converted into the allotropic form, known as "**red phosphorus,**" which is entirely different in its character from the common phosphorus. But, if "*red phosphorus*" be heated to 260° Fahr., it will return to the state of ordinary phosphorus.

144. **Phosphoric anhydride** (P_2O_5) is produced by the rapid combustion of phosphorus in an excess of air, and, when thrown on hot water, produces phosphoric acid (H_3PO_4), as previously stated.

ARSENIC.

145. **Arsenic** is a constituent of many metallic ores, and is used in the arts as *arsenious oxide* (As_2O_3), commonly called *white arsenic.* It is used with acetate of copper in the manufacture of **Paris green.**

146. **Arsenic acid** (H_3AsO_4) is obtained by treating As_2O_3 with HNO_3.

147. **Realgar** (As_2S_2) is a sulphide of arsenic and occurs native, as does **Orpiment** (As_2S_3).

148. The best antidote for arsenious poisoning is a mixture of freshly precipitated *ferric hydrate* ($Fe_2H_6O_6$) and *caustic magnesia.*

ANTIMONY OR STIBIUM.

149. **Antimony** occurs native, and, alloyed with metals, it is a brittle solid of bluish-white color and of crystalline form. Antimony burns at a red heat, producing **antimony teroxide** (Sb_2O_3), which occurs as a native mineral.

Type metal contains about twenty per cent of antimony.

Antimony is used with many metals as an alloy.

150. **Gray antimony,** or **antimony tersulphide** (Sb_2S_3), is a native mineral, and the source of the antimony of commerce.

Antimony received its name from the observation of Basil Valentine, the monk of Germany who discovered it, that, while swine thrived when fed with it, the monks died by using it; hence called anti-monk, *anti-moine,* — *antimony.*

BORON.

151. **Boron** occurs in nature as **boracic acid** (H_3BO_3), and as **borax,** or **sodic biborate** ($Na_2O,2B_2O_3,10H_2O$).

Borax is employed in welding.

Boron is obtained in an amorphous state, like charcoal, and also in a crystalline form.

BISMUTH AND GOLD.

152. The metallic triads, *bismuth* and *gold,* have little chemical interest, being almost invariably used in the metallic state.

Bismuth dissolves in nitric acid, and *gold* dissolves in a mixture of HCl and HNO_3, called "*aqua-regia*" (royal water).

CARBON.

153. **Carbon** is the most important of the tetrads. It occurs in three distinct allotropic forms, as **charcoal** or **lampblack,** the result of the expulsion of all the elements but carbon from either animal or vegetable substances, as **plumbago,** or **black-lead**; a mineral called *graphite;* and as pure crystallized carbon in the gem called **diamond.**

All these, when strongly heated in contact with oxygen, unite with it to form *carbon di-oxide* (CO_2). This is always the result of the combustion of carbon. This CO_2 is also produced by chemical action, which occurs in the lungs on each inhalation of air.

154. **Gas carbon** is obtained from gas-retorts used in the manufacture of illuminating gas. It is employed in the manufacture of galvanic batteries and the carbons for the electric light.

155. **Coke** is impure carbon, resulting from the distillation of bituminous coal.

The affinity of carbon for oxygen is very strong.

156. A current of steam passed over red-hot charcoal produces an inflammable gas called **carbon protoxide**, or **carbon monoxide** (CO). This gas burns with a blue flame, and produces carbon di-oxide (CO_2), above mentioned.

157. **Charcoal** destroys odors and removes colors, and is on this account used in the purification of sugar, and for many chemical purposes.

158. **Carbon di-oxide** or **carbonic-acid gas** (CO_2) may be readily obtained from the carbonates, as potassic, or sodic, or calcic carbonate.

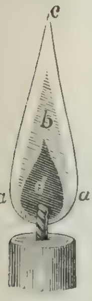


Fig. 14. Flame.

Many of the compounds of carbon with H and O have already been mentioned under acids, ethers, and alcohols, and will be omitted here.

159. **Flame** is the incandescence of minute particles of carbon borne upward by the gas CO_2. The flame of a candle consists of four divisions, — the small, cup shaped part, *a a*, Fig. 14, next the tallow or wax, which is partly gas and partly consumed carbon; the non-luminous cone *d*, which is unconsumed carbonaceous vapor; the luminous part *b*, where combustion is complete, because the oxygen of the air has become thoroughly mingled with the carbon particles; the CO and H burning to form CO_2, and H_2O vapor, and producing a hardly observable envelope, *a c a*, of the whole.

It is by a skilful use of these different parts of a flame that blow-pipe analysis is effected.

160. **Chloroform** ($CHCl_3$) is the result when chlorine acts slowly on marsh-gas (CH_4). It is manufactured by distilling dilute alcohol with *chloride of lime*.

161. **Chloral** (C_2Cl_3HO) is obtained by passing chlorine through absolute alcohol (C_2H_6O).

162. **Formic acid** (CH_2O_2) is secreted by ants, and was first obtained by distilling the bodies of these insects, but is now prepared from inorganic substances.

163. **Stearine** $\left[\left.\begin{matrix}(C_{18}H_{35}O)_3\\(C_3H_5)\end{matrix}\right\} O_3\right]$ is a salt of stearic acid; and *beef-tallow* is chiefly *stearine*. Lard is made up of *olein* and *palmitin*.

164. **Glycerine** ($C_3H_8O_3$) is a secondary product in the manufacture of soaps.

165. **Nitro-glycerine** $\left[\left.\begin{matrix}(C_3H_5)\\(NO_2)_3\end{matrix}\right\} O_3\right]$ is the heavy, oily liquid which collects at the bottom when *glycerine* is gradually added to a mixture of HNO_3 and H_2SO_4.

166. **Oil of turpentine** ($C_{10}H_{16}$) is the oily vapor which passes over to the receiver when the resinous substance which exudes from certain species of pine is distilled with water.

167. **Camphor** ($C_{10}H_{16}O$) is obtained by distilling with water the wood of East Indian laurel.

168. **Benzol** (C_6H_6) is a vapor of coal-tar condensed to liquid. It is valuable as a solvent, and is used to remove grease from silk and woollen.

169. **Toluol** (C_7H_8) resembles *benzol*, and is obtained in like manner.

170. **Aniline** (C_6H_7N) is obtained by distilling indigo with caustic potash. It is used with various chemical agents to produce coloring matter.

171. The *aniline dyes* are obtained from a mixture of *aniline* and *toluidine*.

172. **Carbolic acid** (C_6H_6O) is only the addition of one atom of oxygen to *benzol*, and occurs in the oil distilled from coal-tar. It is a powerful disinfectant.

173. **Cane-sugar**, or **sucrose** ($C_{12}H_{22}O_{11}$) is made from the sugar-cane, from beet-root, and the sugar-maple tree sap.

174. A solution of *sucrose* subjected to the action of yeast produces two varieties of sugar, which have the same formulæ. The reaction is as follows: —

$$C_{12}H_{22}O_{11} + H_2O = \underset{\text{Dextrose.}}{C_6H_{12}O_6} + \underset{\text{Levulose.}}{C_6H_{12}C_6}.$$

175. **Dextrose** ($C_6H_{12}O_6$) is *grape* or *starch sugar*, also called *glucose*, and occurs in ripe fruits, as peaches, pineapples, strawberries, grapes, and cherries. It may be obtained from woody fibre, and by adding H_2SO_4 to linen or cotton shreds, boiling and neutralizing with chalk. It may be obtained in crystals.

176. **Levulose**, or **fruit-sugar** ($C_6H_{12}O_6$) may also be obtained from fruits, and is generally found associated in them with *dextrose;* but it will not crystallize, and is thus distinguished from *dextrose,* as well as by their different chemical action upon an alkaline solution of a copper salt. If a dilute solution of copper sulphate be added to *dextrose* or *grape-sugar* and the solution heated, a yellow precipitate of copper hydrate results; but, if the same course be pursued with *levulose,* no change occurs.

177. While *sucrose — cane sugar* ($C_{12}H_{22}O_{11}$) — undergoes separation as above distributed, *lactose,* or *milk sugar,* which has the same formula, when pure, cannot be fermented.

178. **Starch** ($C_6H_{10}O_5$) is an organism found in most grains and in many roots, as wheat, potato. It is not soluble in water; but when the water is heated to or above 70° Fahr., it swells and bursts, forming a paste. Starch granules vary in diameter from $\frac{1}{300}$ of an inch, as in the potato, to $\frac{1}{3000}$ of an inch, as in rice.

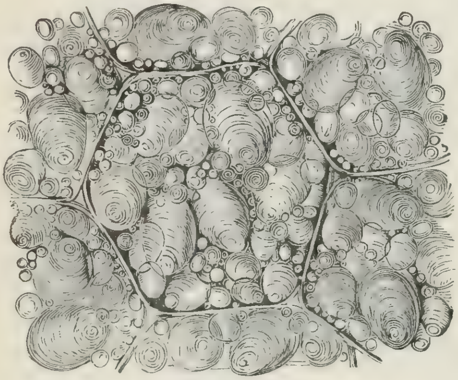


Fig. 15. — Granules of Potato Starch (magnified).

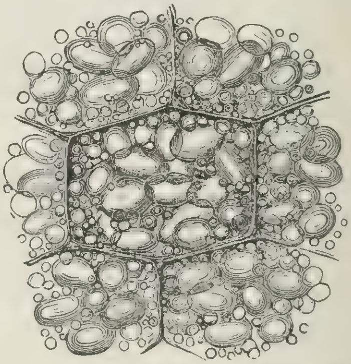


Fig. 16. — Granules of Wheat Starch (magnified).

Figures 15 and 16 show the appearance of granules of starch, as seen under the microscope.

179. **Tapioca** is a variety of starch obtained from the roots of tropical plants, while **Sago** is from the pith of the sago palm.

180. **Dextrin** is the product resulting from the heating of starch to about 205° Fahr. It has the same composition as starch, but has different properties.

181. **Cellulose** ($C_{18}H_{30}O_{15}$) occurs in all parts of plants, making up the external part of the cells of all vegetable organisms. Linen and cotton are nearly pure cellulose, as also is unglazed filtering paper.

It can be converted into *dextrin* and *grape-sugar* by mixing it with dilute H_2SO_4 and boiling the solution.

182. **Gun-cotton**, or **nitro-cellulose**, is the result of adding to cellulose a mixture of nitric and sulphuric acids. A certain number of H atoms are thus replaced by an equal number of atoms of NO_2. Its composition depends upon the proportions of acids and cellulose which are brought in contact.

183. **Collodion** is the name of a solution of *gun-cotton,* or pyroxylin, in a mixture of alcohol and ether.

184. **Gum-arabic** exudes from a species of *acacia,* and is a mixture of the calcic and potassic salts of arabic acid.

185. The **resins** are exudations from various kinds of trees, which become solidified by exposure in the air. They are all hydrocarbons.

Gutta-percha, and **Caoutchouc** or **India-rubber**, are of this character.

186. **Amber** is a fossil substance resembling resin, and contains *succinic acid.*

The exact composition of these resinous substances has not been determined.

SILICON.

187. **Silicon** is second only to oxygen in its abundance and general distribution. It is by weight one quarter of the whole earth; hence, in connection with oxygen, constitutes three fourths of terrestrial nature. It occurs as a compound with oxygen in quartz, flint, rock-crystal, sand, in the silicates, and in rocks generally.

188. **Silicic oxide** or **Silica** (SiO_2) is nearly pure in quartz, rock-crystal, and sand. It also forms in part the external portion of husks and stalks of grain; and combines with the metallic oxides to form the silicates.

189. **Sodic Silicate** (Na_4SiO_4) and glass are the common compounds in the arts.

190. **Silicic acid** (H_4SiO_4) is gelatinous, or like jelly.

TIN OR STANNUM.

191. **Tin** occurs in nature as *stannic oxide* (SnO_2).

192. Uncombined tin is called *block-tin.*

193. **Sheet-tin** is sheet-iron with a coating of tin.

194. **Stannous Chloride** ($SnCl_2$) or tin crystals, and **sodic stannate** (Na_2SnO_3), are used in dyeing.

195. **Albumen** is abundant in the animal body, and is generally recognized in the eggs of birds, the fluid which surrounds the yolk. It is a complex compound of C, H, N, S, and O, the formula for which has never been exactly determined.

196. **Fibrin** occurs in the blood in a soluble state, and in the muscles in an insoluble condition. It contains more nitrogen and oxygen than albumen.

197. **Casein** is in the milk of animals. It is not coagulated by heat, but is thus affected by acids and by *rennet.* The *curd* thus produced, when pressed, is called *cheese.*

198. **Milk** consists of water in which is a solution of casein, milk-sugar, sodic, and potassic chlorides, and calcic and magnesic phosphates. It holds in suspension minute globules of oily matter, which rise to the surface and are called **cream.** When their envelope of casein is broken by churning, a separation of the oily substance occurs, and is called **butter.**

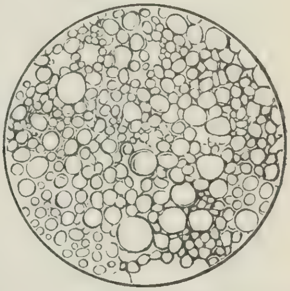


Fig. 17. — A Drop of Cream greatly magnified.

199. **Gelatin** is produced by the action of boiling water on *ossein,* a substance contained in the bones and skin of animals. Isinglass is a very pure gelatin obtained from the air-bladders of cod, sturgeon, and other fishes.

200. **Glue** is an impure variety of gelatin obtained by boiling the hoofs and horns of animals, and evaporating the water.

Yeast consists of microscopic plants made up of cells formed during the process of fermentation. The fermentation which takes place in the juice of the grape, apple, etc., results from the germs of such a plant introduced by the air.

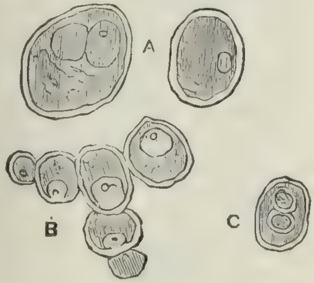


Fig. 18. — Yeast.

AGRICULTURE.

1. The Chemistry of Agriculture consists in the knowledge of the influence of the previously described elements and compounds upon the growth of vegetable matter, and the proper application of this knowledge in the preparation of the soil for the production of vegetation of a specific character.

2. The process of germination or sprouting of plants has been described under the head of Vegetation; and it only remains to show the kinds of sustenance required by different classes of plants, and, so far as may be, the methods of assimilation by them of chemical constituents of the air, and of the soil in which they grow.

3. The spongioles, or fine points of the roots, of plants, as Ohlert discovered, have the office of pushing their way into the soil, while the remaining portion of the root — from the surface of the earth to the *spongiole*, and especially close to it — performs the duty of absorbing moisture, and appropriating the elements necessary for its own structure from the compounds of nitrogen and phosphorus, etc., in the soil. These, by capillary* action probably, are distributed to all parts of the plant, and, by assimilation in the cellular tissues, assist in the building-up of new cells. The oxygen of the water, under the influence of sunlight, is exchanged in the leaves for the carbon of the CO_2 in the air, and thus the plant receives the starch of its woody tissue by supplying the atmosphere with oxygen needed for life-sustenance and combustion of all kinds. Without this chemical action of the leaves of plants, the free oxygen of the air would soon be exhausted and locked up in chemical compounds, and animal life would cease.

4. This action of the leaves is effected through their stomata, or "breathing-pores," which are almost all upon the under surface. The green color of the leaves and their stems is due to the presence of a substance called *chlorophyl*, which undoubtedly takes part in effecting the chemical changes which occur in the leaves; for when the color disappears, the growth of the plant is retarded, or entirely ceases.

5. Chlorophyl is due to the chemical action of sunlight, for it disappears from the leaves of plants when withdrawn from the diffused light of day. The *bleaching* of *celery* is thus effected.

6. The vegetable atom is probably similar to the mineral atom, which is supposed to be spherical or spheroidal, and, under the name of cell-germ, enters into the construction of cellular tissue or cellulose.

The shape of these cells will depend upon the amount and kind of pressure they undergo during

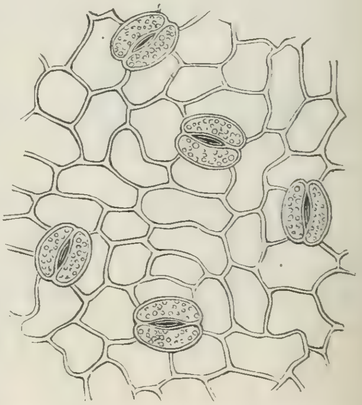


Fig. 1. — A Piece of Leaf-Skin, Showing the Stomata or Pores.

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* See Physics.

formation. The tissue of the cells gradually increases in thickness by assimilation, and chemically is composed of carbon, hydrogen, and oxygen.

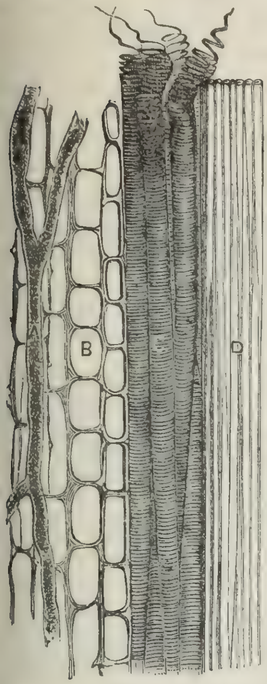


Fig. 2.—Cell Formation of Plants. A represents Milk-bearing Tubes; B, the Pith; C, Spiral Vessels; D, Woody Fibre.

7. When this cellulose is formed under strong pressure, as the walls of the cell increase in thickness it assumes a form called SCLEROGEN, which constitutes the hard woody structure of plants of several years' growth. In trees and the higher vegetable forms, this *sclerogen* or *lignine* forms what is called VASCULAR tissue, which consists in unbranched tubes or ducts.

SOILS.

8. The composition of soils varies largely, according to locality, and is dependent chiefly upon the manner of their formation.

The chemical condition of soils can be in a general manner determined by a knowledge of the character of the rocks whose disintegration produced them, and from the physical conformation of the adjacent country, as well as by the appearance of the soil itself.

9. SANDY LAND is composed principally of *silica*, which does not enter into solution easily, and does not, except in few instances, aid in the growth of vegetation. As a *silicate* it takes part in the construction of the external portions of certain grains. It is safe to say that such soil would require more money to put it into a productive state than could ever be realized from it in return.

10. *Alumina* exists most largely in RICH LOAMS; for, on account of its consistency, it holds the solutions of organic matters near the surface, instead of permitting them to pass through like a sieve, as silica does. It rarely exceeds fifteen per cent of the soil, while the silica mixed with it will be sixty or seventy per cent.

11. In CLAY SOILS generally there will be about seven per cent of *alumina*, while in sandy soils it is only from one to five per cent. Porcelain and brick clays contain about forty per cent of alumina.

12. CLAYS and LOAMS contain from one to three per cent of *calcic carbonate*, while limestone soils contain ninety per cent. The richest loams require about three per cent, and no fertile soil should hold less than one per cent.

Soils which contain the most alumina also contain the most potash and soda, as they should, and ought to have from two to three per cent.

Magnesia is about 1.5 per cent of fertile soils, as also is *phosphoric acid.*

13. FERTILE LOAMS contain from ten to fifteen per cent of organic animal and vegetable matter; but COLD CLAYS have little organic matter, and are little better than sandy soils for cultivation.

14. It has been found that, in a great measure, THOROUGH CULTIVATION or mechanical treatment in the shape of pulverization of the soil, is a fair substitute for manure in the case of good loams; and, if proper dressing cannot be provided, fair crops can still be obtained for a long series of years by *thoroughly working* the soil. The maximum crops are, however, obtained by thorough *tillage* and abundant *manuring.*

The mineral elements which are most abundant in plants are least so in the soil, but sufficient in quantity to supply the yearly demand in connection with the supplemental manures provided by the cultivator.

The reason why the soil should be as finely pulverized as possible is, to bring the particles which are nutritious to plants in contact with the roots; for it is the finest-powdered material of the soil which contains the phosphates, ammonias, potash, etc.

The chief objects of all the various methods of working the soil are, the exposure of the inner portions to the action of light and air, and the consequent conversion of inert organic matter into soluble plant-food, and the withdrawing of the mineral constituents from their insoluble combinations.

On account of the subsoil containing less organic matter than the surface soil, it is best to bring to the surface in ploughing, annually, only a small portion of the subsoil, which can, by the action of the winter's frosts and snows, be so reduced as to supply in a measure the yearly loss of fertilizing matter.

The mechanical treatment of the soil should take place in autumn, and then in the spring should be again thoroughly pulverized. No amount of manure can, in the case of turnips, supply the want of thorough pulverization.

It is necessary that the soil should be thoroughly warmed by the rays of the sun, and this cannot be done if the heat be employed in evaporating excessive moisture; hence thorough drainage of cold, damp, clayey soil is absolutely necessary to productiveness.

When such soils are thoroughly drained, the oxygen of the air can mingle with the soil and produce the decomposition of organic matter, and convert it into carbonic di-oxide (CO_2) and ammonia (NH_3), which furnish the greater portion of vegetable food.

15. The following table shows the composition in 1,000 parts of soils of various degrees of fertility, and indicates the necessary constituents for fertility: —

CONSTITUENTS.	Fertile without Manure.	Fertile with Manure.	Very Barren.
Organic matter	97.	50.	40.
Silica	648.	833.	758.
Alumina	57.	51.	101.
Lime	59.	18.	4.
Magnesia	8.	8.	1.
Oxide of iron	61.	30.	91.
" " manganese	1.	3.	trace.
Potash	2.	trace.	....
Soda	4.	....	....
Chlorine	2.	....	....
Sulphuric acid	2.	1.	....
Phosphoric "	4.	2.	....
Carbonic "	40.	4.	....

16. POOR SOILS are with difficulty made *good*, but can be improved. If sandy soil lies adjacent to heavy clay land, it might ultimately pay to mix the clay with the sand, thus enabling it to hold fertilizing matters in solution.

17. The CLAY SOIL can be benefited by drainage and a liberal application of quicklime, chalk, or marl, which enter into combination with the water in the clay, rendering the latter more porous, and more easily worked. This course, pursued for several years, ought to produce great improvement; for, as the land becomes more easily worked, the air will circulate better in it, and organic matter will be more thoroughly decomposed into the compounds which can be assimilated by plants. There will be little danger of the soil

being rendered too light for the production of *cereals;* and, if too great a quantity of lime has been applied at any time, the temporary injury can be repaired by growing turnips.

Of course very poor land cannot be made equal to naturally good soil, but it can be improved as indicated.

MANURES.

18. **Wheat** and **barley**, and indeed the *cereals* generally, appear to be more influenced in their growth by the use of *ammoniacal* manures than by the application of *phosphatic* or *alkaline* compounds; and, if nitrogenous fertilizers are well supplied, the *cereals* may be produced upon the same ground, through a long succession of years, without rotation of crops, as would otherwise be necessary. When rotation is desirable, wheat should always succeed clover, because it will then be supplied with the required nitrogen.

19. The abundant growth of the *natural grasses* is dependent upon a good supply of *nitrogenous* manure. *Sodic-nitrate* has great influence favorable to the growth of grasses.

20. The *leguminous* plants — *vetches*, clover, etc. — are not particularly benefited by the use of the compounds of nitrogen, but thrive under the application of *alkaline* compounds, especially *potassium salts.* The large leaf-surface of such plants enables them to take all the nitrogen they require from the atmosphere, so that they leave the soil with more ammoniacal compounds in it than it had before, hence in good condition for the growth of the cereals. The leaf-surface of crops seems to determine the kind of fertilizer needed, and it is frequently that of which they contain the least.

21. The growth of plants follows a law of compensation. That which they possess in greatest quantity they leave, and thus prepare the soil for other kinds of crops; and that which they use the least of they thrive upon: hence they seem to act as a laboratory, thriving by their labor, while keeping air and soil in opposite conditions and healthful state by the chemical reactions taking place within their tissues.

22. **Root-crops** — *turnips*, *beets*, etc. — require bulky organic manures, such as usually come in shape of solid matter from farm-yards, and the artificial fertilizer known as *superphosphate* of *lime*, hereinbefore described.

23. **Potatoes** are greatly benefited by the application of the *potassium salts*, *muriate of potash*, and *kelp*.

24. The tables which follow may assist in determining the kinds and quantities of manures to be used at different times.

TABLE SHOWING THE AMOUNT OF VARIOUS ORGANIC SUBSTANCES TAKEN FROM THE SOIL IN 1,000 LBS. EACH OF THE FOLLOWING CROPS WHEN PERFECTLY DRY.

Products.	Carbon. Lbs.	Hydrogen. Lbs.	Oxygen. Lbs.	Nitrogen. Lbs.	Ash. Lbs.
Hay	458	50	387	15	90
Red-clover hay	474	50	378	21	77
Potatoes	440	58	447	15	40
Wheat	461	58	434	23	23
" straw	484	53	389½	3½	70
Oats	507	64	367	22	40
Oat-straw	501	54	390	4	51

Johnston.

TABLE SHOWING THE QUANTITY AND KINDS OF INORGANIC MATTER REMOVED FROM THE SOIL IN 1,000 LBS. EACH OF THE FOLLOWING CROPS.

	Potash.	Soda.	Lime.	Magnesia.	Alumina.	Silica.	Sulphuric Acid.	Phosphoric Acid.	Chlorine.	Oxide of Iron.	Oxide of Manganese.	Total in every 1,000 lbs.
Wheat, grain......	2.25	2.40	0.96	0.90	0.26	4.00	0.50	0.40	0.10	trace.	....	11.77
" straw......	0.20	0.29	2.40	0.32	0.90	28.70	0.37	1.70	0.30	......	....	35.18
Barley, grain......	2.78	2.90	1.06	1.80	0.25	11.82	.59	2.10	0 19	trace.	....	23.49
" straw......	1.80	0.48	5.54	0.76	1.46	38.56	1.18	1.60	0.70	0.14	0.20	52.42
Oats, grain........	1.50	1.32	0.86	0.67	0.14	19.76	0.35	0.70	0.10	0.40	....	25.80
" straw........	8.70	0.02	1.52	0.22	0 06	45.88	0.79	0.12	0.05	0.02	0.02	57.40
Rye, grain........	5.32	*	1.22	0.44	0.24	1.64	0.23	0.46	0.09	0.42	0.34	10.40
" straw........	0.32	0.11	1.78	0.12	0 25	22.97	1.70	0.51	0.17	......	....	27.93
Field Bean, bean.......	4.15	8.16	1.65	1.58	0.34	1.26	0.89	2.92	0.41	......	....	21.36
Field Bean, straw.......	16.56	0.50	6.24	2.09	0.10	2.20	0.34	2.26	0.80	0.07	0.05	31.21
Field Pea, pea........	8.10	7.39	0.58	1.36	0.20	4.10	0 53	0.90	0.38	0.10	....	24.64
Field Pea, straw......	2.35	......	27.30	3.42	0.60	9.96	3.37	2.40	0.04	0.20	0.07	49.71
Potatoes, roots....	4.028	2.334	.331	.324	.050	.084	.540	.401	.160	.032	....	8.284
Potatoes, tops....	8.19	.09	12.97	1.70	.04	4 94	.42	1.97	.50	.02	....	30.84
Turnips, roots...	2.386	1.048	.752	.254	.036	.388	.801	.367	.239	.032	....	6.303
Turnips, leaves..	3.23	2.22	6.20	.59	.03	1.28	2.52	.98	.87	.17	....	18.09
Carrots...........	3.533	.922	.657	.384	.039	.137	.270	.514	.070	.033	.060	6.619
Parsnips..........	2.079	.702	.468	.270	.024	.162	.192	.100	.178	.005	?	4.180
Rye grass.........	8.81	3.94	7.34	0.90	0.31	27.72	3.53	0.25	0.06	......	....	52.86
Red clover........	19.95	5.29	27.80	3.33	0.14	3.61	4.47	6 57	3 62	......	....	74.78
White clover......	31.05	5.79	33.48	3.05	1.90	14.73	3.53	5.05	2.11	0.63	....	91.32
Lucern...........	13.40	6.15	48.31	3.48	0.30	3.30	4.04	13 07	3.18	0.30	....	95.52
Sainfoin..........	20 57	4 37	21 95	2.88	0.66	5.00	3.41	9.16	1.57	......	....	69.57

Sprengel.

The composition of the excreta of the farm animals is shown in the following tables:—

COMPOSITION OF THE SOLID EXCRETA OF THE ANIMALS OF THE FARM.

1,000 parts contain,—	Horse.	Cow.	Sheep.	Pig.
Water..............................	750	850	640	700
Solid matter..........................	220	150	360	220
Containing nitrogen equal to ammonia,	6	3.5	6	7
" phosphoric acid equal to phosphate of lime.......	8	6	5	5
Alkaline salts..........................	3.5	2.20	3	5.5

COMPOSITION (PER 1,000 PARTS) OF THE LIQUID EXCRETA OF THE FARM ANIMALS.

	Horse.	Cow.	Sheep.	Pig.
Water..............................	900	920	900	975
Solid matter..........................	100	80	100	25
Containing nitrogen equal to ammonia,	14	9	14	3
" alkaline salts............	14	16	10	2

The amount of phosphoric acid is very small in the liquid excrements, varying from a trace to about 0.1 per cent in the case of horses, oxen, and sheep. In pigs' liquid excreta it amounts to from 0.75 to 1.5 per 1,000 parts.

The composition of the excreta of the farm animals is very variable, and is greatly influenced by the nature of the animal's food and other conditions.

According to Boussingault, when estimated for their relative values as nitrogenous manures, each of the following amounts of decomposed vegetables equals 100 pounds of farm-yard manure as generally constituted: —

130	pounds of wheat straw manure.	80	pounds of fresh seaweed manure.
150	" " oat " "	20	" " dried " "
180	" " barley " "	26	" " bran of wheat or corn manure.
85	" " buckwheat straw manure.	13	" " malt-dust manure
45	" " pea " "	8	" " rape-cake "
50	" " wheat chaff "	250	" " pine-sawdust "
80	" " green grass "	180	" " oak " "
75	" " potato tops "	25	" " coal-soot "

25. The *solid* excrement of the farm-yard contains much less free ammonia, or nitrogen compounds, as well as less quantity of the phosphates and alkaline salts, when the *liquid* portion is allowed to drain away. In fact, nearly all of these compounds are contained in the liquid portions of farm-manure; hence it behooves the farmer to keep them from running to waste. The solid manure of the horse is much more valuable than that of other animals; for it is a warm, easily fermented manure, permitting free circulation of air, and consequently more rapid decomposition.

26. PERUVIAN GUANO is the best *nitrogenous* manure, containing, when pure, between fifty and sixty per cent of nitrogen compounds. The genuine article of good quality has a light-brown or grayish color, and consists of powder mingled with hard lumps, which exhibit a crystalline appearance and lighter color when broken. A bushel of good guano weighs only about seventy pounds, while an adulterated article will weigh nearly one hundred pounds, and sometimes more.

A *fair test* is to burn three fourths of an ounce of the article upon a piece of tin or iron over a clear fire. If the residue or ashes be not more than one fourth of an ounce, the guano will be pure; but if it be one half ounce, the guano will be a gross adulteration. The best results follow the use of this manure upon *heavy soils*, while *light soils* afford better results from the use of phosphatic manures.

Sal-ammoniac or *ammonic chloride* and *ammonic sulphate* are valuable nitrogenous manures, and *sodic nitrate* is an excellent top-dressing for the cereals.

27. The *liquid* manure of the farm-yard, consisting of an equal amount of horse, cow, and sheep manure, is worth, as compared with Peruvian guano at $68.00 per ton, about $27.00 per ton; as compared with Bowker's dry-ground fish at $40.00 per ton, about $50.00; and as compared with the best superphosphate of lime at $50.00 per ton, it is worth about $40.00.

28. THE PHOSPHATES are so various in composition that a farmer should not purchase without a guaranteed analysis of the article. Good *bone phosphate* should contain 22 to 26 per cent of soluble phosphates, and from 1.2 to 2 per cent of ammonia. A *mineral* phosphate should have from 26 to 35 per cent of soluble phosphates.

The average sample of Peruvian guano has until recently had the following composition in each one hundred parts: —

Water	12
Nitrogenous organic matter and ammoniacal salts (yielding 16 parts ammonia)	56
Tribasic phosphate of lime	22.5
Alkaline salts	9
Insoluble mineral salts	.5

At present, the best Peruvian guano, as offered for sale, is much inferior in quality to that above mentioned; but this will serve as a guide to determine the extent of its adulteration. The greater the quantity of nitrogen in it the better the quality.

29. The application of town sewage to agricultural purposes is not only of great advantage in the way of increase of all kinds of crops, but produces great improvement in the health of the inhabitants, and abates what has become in many cases an intolerable nuisance. Carbolic-acid compounds are added to sewage manure to prevent foul effluvia.

FOOD.

30. There seems to be no doubt that the most valuable kinds of food for oxen, sheep, and pigs are those containing the largest quantity of palatable fats and oils; while for horses and other working animals less fatty matter is more economical. A large percentage of the food consumed by animals is used in keeping them warm; hence the more comfortably animals are housed, providing good circulation of air is secured, the better for both animal and farmer.

31. Since animals kept for different purposes require varying proportions of fats, albumen, etc., it may be of advantage to the farmer to know what kinds of food contain the most of the necessary ingredients. We give, therefore, the following results of various analyses made by Prof. J. W. Sanborn, of the New Hampshire Agricultural College, showing the number of pounds of digestible matter in each one hundred pounds of American products: —

	Proteine.	Carbo-Hydrates.	Fats.	Ratio.
	Lbs.	Lbs.	Lbs.	
Average of 14 analyses of timothy hay	4.25	42.13	.97	1 to 10.4
“ “ 5 “ “ clover hay	5.00	39.26	92	1 “ 7.4
“ “ 9 “ “ meadow hay	3.34	35.79	.75	1 “ 11
“ “ 2 “ “ oat-straw	2.42	38.95	.86	1 “ 17
“ “ 9 “ “ corn-fodder	.75	7.10	.07	1 “ 10
“ “ 4 “ “ cured corn-fodder	2.82	43.47	1.03	1 “ 16
“ “ 3 “ “ cotton-seed meal	35.57	12.79	14.35	1 “ 1.3
“ “ 18 “ “ wheat-bran	7.71	49.55	3.07	1 “ 7.3
“ “ 9 “ “ corncobs	.94	44.49	.11	1 “ 47
“ “ 10 “ “ linseed meal	24.72	22.90	10.51	1 “ 1.9
“ “ 1 “ “ barley	10.58	60.75	2.11	1 “ 6.2
“ “ 2 “ “ oats	7.32	45.12	3.85	1 “ 7.3
“ “ 31 “ “ flint-corn	8.98	66.01	3.87	1 “ 8.3

In connection with the table, Professor Sanborn remarks: —

“ Proteine, or albuminoid, finds its distinctive function in construction of muscle (lean meat), tendons, ligaments, and cartilage. No other portions of a food can fill its place, as they are devoid of nitrogen. Proteine forms fat, may support heat in case of necessity, and is assumed by many physiologists as the source of force. The chief function of carbohydrates is to maintain the heat of the body. This is contended by many, with much show of reason, to be the source of force, and a possible source of fat. The fats of food have their distinctive field in fat formation. The minerals, or ash, are the basis of the bony framework. From the table it will be seen how the want of one kind of food may be supplied by another. Thus, if corn-meal given to a calf failed to furnish the desired amount of proteine, barley, linseed, or cotton-seed would replace it to advantage.”

He further says: "The science of feeding, then, consists not merely in giving hay or grain, but in furnishing the requisite amount of proteine, carbo-hydrates, fats, and ash, daily, in amounts sufficient for the growth of the animal, or the purpose for which it is kept. Hay, therefore, cannot be looked upon as a perfect animal food; for, while the animal changes at each period his relative demand for proteine, etc., that of the hay remains fixed."

The Germans recommend, from their experiments, the following amounts of food daily per one thousand pounds live weight: —

	Proteine.	Carbo-Hydrates.	Fats.	Ratio.
	Lbs.	Lbs.	Lbs.	
Ox at rest	.7	8	.15	1 to 12
Ox at hard work	2.4	13.2	.5	1 " 6
Milch cow	2.5	12.5	.4	1 " 5.4
Fattening oxen	2.5	15	.5	....
Growing cattle from 2 to 3 months old (weight 150 lbs.)	.6	2.1	.3	1 " 4.7
" " " 3 " 6 " " 300 "	1.	4.1	.3	1 " 5
" " " 6 " 12 " " 500 "	1.3	6.8	.3	1 " 6
" " " 12 " 18 " " 700 "	1.4	9.1	.28	1 " 7
" " " 18 " 24 " " 850 "	1.4	10.3	.26	1 " 8

32. The use which may be made of the foregoing tables will appear in the following illustration: —

"Seven steers, weighing 500 pounds each, will consume daily about 100 pounds of timothy hay, which contains 5.4 pounds of digestible proteine, and 45.5 pounds of carbo-hydrates; hence they would not eat enough hay alone to supply their needs, as shown by the table, which are 9.1 pounds of proteine, and 47.6 pounds of carbo-hydrates. How shall the desired amount be filled?

"Looking down the preceding table of foods, we see that cotton-seed meal is rich in proteine; and, by using it, we find that this food, with the lessened amount of hay required, will give the desired quantity of both proteine and carbo-hydrates.

"If enough of a given food were consumed to furnish all the minerals, fats, and carbo-hydrates needed for the most rapid growth, but only one half the required amount of albuminoids, no continuous rapid growth would be possible: economy would demand the addition of an albuminous food."

33. The use of ENSILAGE as a food has created much interest, not to say excitement, among all classes of farmers, and we think greatly to their detriment, and is liable to be an injury to the over-sanguine.

It is quite ridiculous to suppose anything in the nature of food will be added to corn-fodder by its fermentation. There will necessarily be a loss, and undoubtedly a greater one than by the ordinary drying process. The animal body has been most admirably fitted for the making of silo; and a moment's thought must convince one that, so far as the production of heat in the animal is concerned, there is a waste in allowing the fermentation to take place in a vat instead of in the animal, as would be the case were it given the dry food. Aside from the chemical aspect of the case, actual experiments by the most scientific practical farmers have been well summed up by Professor Sanborn, as follows: —

"I have fed with equal success *less* organic matter in *dry* foods than the most sanguine enthusiast claims is necessary in using ensilage. Professor McCook, in actual experiment, fed a given number of pounds of dry matter in ensilage, which amounted to 18.3 pounds of digestible nutrients against the same amount in air-dry foods, and the latter produced the best results. In my own experiments I used two pounds less of digestible dry matter per day, and obtained as much milk as from sixty pounds of ensilage and five pounds of meal."

Professor McBryde's experiments resulted in the same way. Professor Cook, of the New Jersey Experiment Station, obtained results decidedly unfavorable to the feeding value of ensilage: "I fed from eighty to one hundred pounds of corn-fodder, for three separate years, to cows, against hay, noting the exact weights of milk (and it is claimed that two pounds of ensilage equal one pound of hay); and yet that quantity of the corn-fodder, even the one hundred pounds, did not make so much milk as twenty pounds of hay.

"I believe in corn as strongly as any ensilagist in the country, but a silo is not necessary to grow it. You can feed more cattle from an acre of *corn matured* than you can from an acre of ensilage. If you look at the science of it, you will find that the nitrogen of the plant has not been organized into flesh-formers at the time you cut it for ensilaging, hence cannot furnish that necessary quality of food.

"Previous to experimenting, I was an ardent advocate of cutting hay as it went into bloom; but after ten experiments I had to change my opinion, both on account of the practical results and the scientific fact ascertained, that the plant is not fully organized food at the time of bloom, and the nitrogen is not then organized as albuminoids; and it is only in that state that it will make flesh."

34. On the subject of food, Professor Sanborn further says that, if he "had hay worth twenty-five dollars a ton, oat-straw worth eight dollars per ton, and dry corn-fodder worth eight dollars per ton, he would sell the hay, and use oat-straw and corn-fodder, and buy limited amounts of clover (which can often be obtained for less than the hay would be sold), because it is worth half as much more than hay as a fertilizer. I would feed the straw and corn-fodder, with the addition of about six pounds of cotton-seed meal, to each cow daily. All things considered, cotton-seed meal is the cheapest food for cows, in connection with oat-straw and corn-fodder."

35. The oat is the hardiest of all the cereals, and can be cultivated where wheat and barley will not grow; hence there is no reason why it should not be cultivated in the Northern States, and especially in New England, thus providing one of the best foods at home. In regard to steaming hay for cattle, which course is pursued by some experimental farmers, we think it only necessary to say that its utility is very doubtful: some loss is certain, and the cost and trouble outweigh fancied benefits.

AGRICULTURAL DRAINAGE AND IRRIGATION.

36. Agricultural drainage consists in freeing land from superfluous water, and is employed not only to reclaim marshes, but to improve wet land already under cultivation.

37. Irrigation consists in carrying water on to the land in order to increase its fertility.

38. Although drainage and irrigation apparently have different objects, yet they are not opposed. While drainage frees land from superfluous water, it also is the means of causing a larger body of water to pass through the soil drained, instead of *flowing off* its surface carrying valuable material with it. Drainage is, therefore, a means of altering the condition of the water in the soil, rather than of depriving the soil of so valuable an element of fertility. By it a stagnant condition is changed into movement, and the full advantages of rain are realized.

39. Likewise, the benefit of irrigation is owing to the constant motion of the water,

which is thus made to yield its fertilizing matters to the soil. Thus it is a supplement of drainage, instead of an opponent. Water is most beneficial to soil when the drainage is such as to let the water settle through it, before running off, to such a depth as to leave a few inches of surface soil unsaturated; thus giving the oxygen of the air an opportunity to effect a more perfect decomposition of both organic and inorganic matters, which would otherwise become injurious to vegetation.

40. The greatest evil of defective drainage is the loss to the soil of the beneficial influence of the sun's heat; for, if the surface be very wet, this heat will be expended in evaporating the surplus water instead of in warming the soil.

41. Among the beneficial results of proper drainage may be mentioned the general improvement of the land, the higher temperature of the soil, the more effective action of manures, the disappearance of the inferior classes of water herbage, the increase of products, earlier harvests, and the unquestionable improvement of the health of live stock and of people.

42. Professor Wrightson, of the Royal Agricultural College, says that, "so long as land is constantly wet, it is not subjected to the modifying influences of contraction and expansion to so great an extent as drained soils. A drained field is alternately, and within a very short period, wet and dry; it is also acted upon by the atmosphere; and that weathering action which, in the long course of time, has broken down and pulverized rocks, and so formed soils, is promoted, so that further pulverization and a finer mechanical condition of the soil is the result. The alternate contraction and expansion also cause the formation of a deeper layer of available soil, and render lighter the work of cultivation. As water rises from the deeper layers of the soil to the surface, it brings with it the saline substances it has taken up in solution. These are carried by capillary action to the surface, where, as the water is evaporated, they are left in the form of an incrustation, which to a great extent prevents the entrance of air into the soil. This phenomenon is frequently noticed in the case of flower-pots watered by means of a saucer. In this case the water, as it evaporates from the upper surface of the soil, leaves a white efflorescence, which, from the cause already referred to, is prejudicial to the plant, and requires to be frequently broken up in order to admit air. The same phenomenon has been observed in the case of agricultural soils.

"Soils are wet from three causes, — from direct rainfall, from springs, and the soaking down of water from higher grounds. The greater part of our retentive soils are wet from the arrested descent of rain-water as it seeks a lower stratum. Springs usually occur on the sides of hills, and owe their existence to the presence of a bed of clay, or other retentive material, at a greater or less distance from the surface. When rain falls upon a porous soil it sinks in without difficulty, until it meets with an obstruction. Here it accumulates, and may be reached by boring a well down to it. Supposing, however, that this obstruction, probably clay, crops out upon a hillside at no great distance, there you will have springs. As soon as the water rises in the natural reservoir until the lip of the basin is reached, it will overflow, and cause wetness in the land immediately beneath it.

"A field is wet, and requires draining. It is wet simply because the water cannot escape, and this may be due to the general retentiveness throughout the mass, as is the case in clay soils; or to an obstructing bed at some little distance beneath the surface.

"Vigorous treatment is requisite, and no system of wide intervals between drains would be successful. The drains must be close enough to exert what Mr. Bailey Denton has termed a reciprocating effect upon one another, — that is, so close that the action of one shall extend into the region of action of its neighbor. After the full effects of thorough drainage have been brought to bear upon a clay soil, the water will pass through it and finds its way to the drains, in the same manner, but never with the same facility, as in lighter soils. Let us, then, turn to the case of a more porous soil wet from direct rainfall.

"Here we must suppose a definite obstruction to the downward passage of water. The water tends to pass through the soil in straight lines, according to the law of gravity. It meets with the obstruction, and begins to rise upon it towards the surface. There is no limit to its rise. It may form a lake, or it may be the cause of a marsh. In other cases it will not rise to the surface, but form what is known as a "water-table," one, two, or more feet beneath.

"Now this water-table, or level of supersaturation, is not the limit of wetness. Over it is a stratum of greater or less thickness, depending upon the character of the soil, wet from capillary attraction; and, if this force raises water to the surface, the land requires draining. Capillary attraction may be defined as a triumph of adhesion over cohesion and gravity. When a piece of wood or metal is dipped into water and withdrawn, its wetness may be explained by the fact that the adhesion of the liquid to the object introduced is stronger than its cohesion to the remaining water it has left, or to the downward force of gravity.

"A similar attraction is exerted by the soil and many familiar porous substances when placed in contact with water. The superior force of adhesion lifts a tiny column of water through the interstices of the porous material presented, until the weight of the column thus lifted counterbalances the attraction of adhesion, and the limit of the force is reached.

"A healthy soil should have a layer of earth at its surface a few inches in thickness, which must not be continually wet even from water raised by capillary attraction. It will be readily seen that, if such a layer does not exist, capillarity and evaporation will, between them, lower the temperature of the soil considerably."

43. In irrigation, the water may be applied upon the surface or beneath, and the clearer the water the better; for the presence of mud or other suspended matter is undesirable, owing to the retardation of the growth of plants by the deposit of solid particles upon their leaves.

ROTATION OF CROPS.

44. It must be apparent, to any one who will give the subject a moment's thought, that the repeated growth and removal of crops from land, without in some way making a return, will in time exhaust the productive power of the soil; that any one species of plant requiring certain kinds of food, grown for a series of years upon the same land, will exhaust the soil of those particular constitutents, and leave those which might be needed by another species of plant; that this second species might flourish upon the soil exhausted as regards the first species, and even be the means of furnishing the soil with the fertilizing properties required by that species.

These manifest truths are the basis of certain systems of rotation of crops which all good farmers adopt as soon as they have ascertained the chemical constitutents of their land, and considered what crops are adapted to the local conditions, climate, etc.

45. Green crops act as exhausters of the soil, while forage or root crops renew its fertility, because they are consumed upon the land, and, since they are sown late, they allow the land to be thoroughly cleared. As these crops are sown wide apart, they permit thorough cultivation of the soil, and not only admit of liberal applications of manure, but are themselves converted into manure; hence they are well adapted for rotation with grain crops.

Fallow, clover, and beans are, in rotation, good preparations for wheat, but are deficient as means for providing food for live stock.

The best known and most extensively used rotation is as follows: Roots, barley, seeds, wheat.

The following plan, proposed by Mr. Stace, has many advantages where the season has sufficient length: —

1ST YEAR. — Winter vetches consumed on the land in May and June, followed by swedes, turnips, and rape; the root-crop and rape fed off as early as possible in autumn.

2D YEAR. — Wheat, seeded half with trefoil and half with clover.

3D YEAR. — Trefoil, mown early and sown with turnips, to be fed. Clover mown and fed.

4TH YEAR. — Wheat.

5TH YEAR. — Winter beans, followed with winter vetches, as above.

46. *Carrots* require a deep, loamy soil, free from stones.

47. *Cabbages* — both late and early, close and open headed — form an excellent crop for stiff soils.

48. *Rape* is cultivated for its leaves, which form a very desirable food for sheep.

Professor Wrightson gives the following directions for the preparation of the ground for wheat: —

" *Wheat after bare fallow* should be sown early in September. This order of cropping presupposes stiff clay soil and on such soils the earlier the seed is planted the better.

" *Wheat after roots* receives the benefit of all the cultivation bestowed upon the roots. When these are carted off, or fed on the land, plough three to four inches deep, harrow, and drill. A fresh furrow is preferred.

" *Wheat after clover.* — Eat the pastures bare by means of ewes or other store stock, and plough early, so as to insure a stale or old furrow. In some cases ploughing is done at the beginning of August, or even earlier; and, as a general rule, you can hardly begin too soon. Crosskill or Cambridge roll immediately, to kill the grass and render the ground firm. Harrow repeatedly before and after the drill.

" *Wheat after beans.* — Cart twelve to fifteen loads of dung on to the bean stubble, plough, and harrow, previous to sowing.

" *Wheat after potatoes.* — Plough or lightly cultivate, harrow and sow. Land is often too light or hollow after potatoes for wheat; hence deep ploughing is to be avoided.

" We cannot recommend indiscriminate deep tillage for wheat. However advisable such a method of cultivation is for stiff soils, over large tracts of light and medium soils it is best to stir the ground deeply for root-crops and plough lightly for cereals."

49. Barley occupies a leading position upon all light and medium soils, and usually follows a root-crop consumed upon the land by sheep. Barley, being required for malting, is allowed to ripen more thoroughly than wheat.

50. OATS derive more benefit from rotation than any other crop. There seems to be some advantage in mixing two varieties together for seed. Oats should be cut early, because they are liable to blow out, and because the straw is a valuable cattle-food when cut in good season.

51. BEANS are suitable for stiff clay soils, excepting winter beans, which may be grown successfully on lighter lands.

52. PEAS are more delicate than beans and require a lighter soil, growing best on lands which contain considerable quantities of lime.

In preparing the soil for both peas and beans, the wheat or oat stubble should be harrowed and weeded, and the weeds burned and the ashes spread on the ground. Manure, at the rate of fifteen loads per acre, should be spread on the land, and the land ploughed four and one half to five inches deep. If the land be free from weeds, the manure may be carted on without previously harrowing.

CATTLE.

53. No breed of cattle has been so artificially produced, or had such a rapid rise, or obtained such a widespread popularity, as the DURHAM SHORTHORN, and no one breed possesses such a combination of those qualities for which cattle are prized.

However unnatural a system of breeding from near affinities may be generally, it has certainly succeeded in this case; and it is probably true that cattle and sheep may be bred in close relationships with advantage, while such a course with horses and pigs would be injurious.

Prof. Wrightson gives the following as points of excellence to be looked for in shorthorn cattle: —

"The color may be red, white, red and white, or roan, but black is not allowed on any part of the body. The hair is plentiful, long, lying in various directions, and of mossy, rich appearance. The animal is docile, the female carrying a sweet-looking head, with a quiet eye. Horns of moderate length in the cow; short, thick, and spreading in the bull. The muzzle is cream-colored, and the horns are waxy, with streaks of red at the base. The bull has a noble carriage and fine head, with hair curling over his forehead and between his horns. It is the head which gives what is termed 'character' among breeders. The rump-bone, when the animal is lean, should be about two inches off, and the upper portion of it level with the under side of the tail. When an animal is narrow at this point, there is often a want of lean flesh and substance between the rump and hips. The quarter, or length from rump-bone to hip, should be long and full of lean flesh; the hips should be wide across, especially in the female, and the hip-bones rounded and well covered; the loin must be flat and wide; the space between hips and ribs moderate; the ribs well arched and deep, giving a round 'barrel'; the back straight; the breadth of the loin maintained by the spring of the ribs, and shoulders wide across; the belly line parallel with the back, giving a uniform, cylindrical body; the flank well let down; thighs heavy-fleshed and deep; buttocks full on both sides; shoulders snugly laid back into the crops; the bosom deep, wide, and prominent; the neck thick at the base, but tapering to the head; the head broad between the eyes, and tapering to the muzzle. Whether viewed from front, back, sideways, or from above, the animal should approximate as nearly as possible in general outline to a parallelogram form. This is difficult to realize, but a glance at truly well-made cattle will convince the observer that a certain squareness of form is the best type of bovine symmetry. In addition to a correct form, shorthorns must also possess the essential trait of 'quality' or 'touch.' In other words, the skin must be soft, pliant, neither too thin (papery) or too thick (heavy), and moving with a characteristic ease upon the cellular matter beneath. This peculiar handling of cattle accompanies aptitude to fatten, and it is spoken of as 'quality.' Quality is also indicated by an abundant coat of fine, silky, well-laid hair. The necks of the Booth shorthorns are remarkable for their bulky and yet symmetrical development, gradually swelling as they approach and blend with the shoulders and breast, and completely hiding the shoulder-points even in the unforced animal."

54. HEREFORD CATTLE are commonly red with white faces, and are large and fine in appearance. They fatten as readily as the shorthorns, but the cows are poor milkers. The beef is of a fine marbled appearance, and of excellent quality.

55. THE AYRSHIRE CATTLE are famous as dairy stock. The typical Ayrshire cow is formed for milk. Her long, fine head and upturned horns are succeeded by a thin neck, no great depth of bosom, shoulder tops and crops narrow, ribs well sprung, and great breadth over the hips.

Looking at the side of the animal, the depth should gradually increase backward towards the flanks, giving what is termed the wedge-form.

This is insisted on by all Ayrshire breeders, and it signifies the gradual thickening of the animal from the set-on of the head, where the neck is light, to the base of the neck, the breast, the girth, and still greater depth at the flank.

This gradual deepening contrasts with the heavy fore-end of the shorthorn, and indicates milking rather than feeding properties. Milk is, indeed, their specialty.

56. Professor Wrightson says, concerning cattle and sheep raising: —

"CATTLE-BREEDING may be divided into the breeding of high-bred or pedigree stock, and the breeding of good, useful cattle intended for the production of beef and milk. The first division represents the breeding of animals with the object of improving the race generally; and the second, while it participates in the improvements effected by the first, has for its object the immediate supply of the consumer. In the first, a perfect form, fine quality, and unspotted lineage are essential; in the second, a 'good sort' is all that is asked for, — cows which give plenty of milk, healthy, growing young stock, and steers which will yield a good return for the food they consume. Such animals are very frequently the produce of ordinary 'useful' cows and pure-bred shorthorn bulls. We have already given sufficient space to the principles of breeding pure-bred stock; and we now turn to the management of more ordinary cattle, such as are to be met with on all well-managed mixed husbandry farms.

"The calf is affected previous to its birth by the treatment of its mother. Cows should not, therefore, be milked when within six weeks of calving, if we wish to obtain well-nourished and well-grown calves.

"Mr. Bowick, manager of Mr. Howard's farm and herd, in an admirable essay on calf management, gives the following allowances of milk as requisite for calves: —

"'1st week, with the dam, or four quarts per day, given in two meals.
"'2d and 3d weeks — five to six quarts, given in two meals.
"'4th and 5th weeks — six to seven quarts, given in two meals.
"'6th to 12th week — eight quarts, given in two meals.'

"Further, Mr. Bowick makes the following alterations from new to old milk: 'New milk is given the first fortnight; the third week, skim-milk is substituted to the extent of one third the allowance; and at the fourth week, the new milk is reduced to one half, and boiled linseed gruel is added.'

"MANAGEMENT DURING THE FIRST WINTER.—Too often a starvation system has been followed in the wintering of young cattle. While we discountenance pampering, we certainly recommend a liberal plan of feeding, regulated by the quality of the grass land into which the young stock will be turned the succeeding summer. It would be the height of folly to feed young animals with expensive forcing foods in the winter, and then to turn them into poor, bare pastures in the summer. Rather let us keep the future in view, and secure a steady, healthy growth from first to last. The usual system is, to place the yearlings in a fold provided with a shed; to give them a fair allowance of roots, barley or oat straw, and hay, cake, or corn, according to the liberality of the farmer who owns them.

"The yearlings meanwhile should be well cared for, regularly fed, gradually changed from poorer to richer fare, supplied with fresh water, and placed in warm, dry, well-ventilated, quiet sheds. With such feeding and surroundings, every particular of which is of great importance, we may hope to see well-grown, healthy yearlings, ready for turning out to grass in the spring.

"MANAGEMENT DURING THE SECOND SUMMER AND SECOND WINTER. — This is simple enough. The second summer the young cattle will be out at grass. The second winter they will again be brought into the yards, and fed according to the purpose for which they are intended. If to run once more on poor land during their third summer, straw and a few turnips will suffice; if to be brought out as 'fresh beasts' and offered to the graziers of good land, then they will be proportionately better 'done.' Straw and about three pounds of rape-cake will keep such cattle alive and healthy."

BREEDS OF SHEEP.

57. "The Cotswold sheep stands high on his legs, and carries a heavy carcass and a grand head. The face and legs are, as a rule, white, but spots of gray are not considered as indicative of impurity of race. The face is wedge-shaped, wide between the eyes, and black skin, where it shows at the nose and eyes. Pinkness of skin on the nose indicates delicacy in this breed as well as in Leicesters. The head is surmounted by a top-knot, or long lock of wool hanging over the eyes, and always looked for in a sheep of any pretensions to merit.

"The Cotswold is next to the improved Lincoln in size, and may be readily brought to twenty-five pounds per quarter at ten months old. The fleece, under ordinary circumstances, will weigh from eight to ten pounds; but extraordinary weights, rising to double those just given, are not uncommon in good flocks.

"The Lincoln is the largest and heaviest-fleeced sheep we possess, and instances are on record of sheep having weighed eighty to ninety pounds per quarter. It in many respects closely resembles the Cotswold sheep, but is furnished with a less prominent top-knot, and is straighter along the top, carrying the head somewhat lower. The wool is exceedingly long, and has a peculiar glistening appearance, which has earned for it the name of 'lustre wool.'

"SHORT-WOOLED SHEEP. — Foremost among these is the *Southdown* or *Sussex Down*, native to the chalk range which extends to the east and west of Brighton. It is the most beautiful race of sheep in the country, and, when exhibited at our great shows, never fails to attract the admiration of the public. The modern Southdown owes its improvement to the Ellmans of Glynde, in the last and present century.

"The Sussex Down is of very symmetrical appearance, and the beauty of its form is the more apparent on account of the shortness of its fleece. The face and feet are fawn-colored, and the head has much of the character of the fallow-deer; the eye is set in a not too prominent orbit; the crown is well covered with closely applied wool; the wool comes well forward upon the cheek, but it is not permitted between the eyes and nose; the 'chap,' or under jaw, is clean, or free from flesh; the fleece is short, and firm 'as a board,' showing cracks down to the skin when the animal turns. The remaining points relating to the general form of the carcass are similar to those looked for in other well-made sheep."

MANAGEMENT OF SHEEP.

58. "The disadvantage of keeping a ewe flock upon really good land is, that ewes require to be kept comparatively poor during a considerable portion of the year, — a condition which it is difficult to observe upon good land. Consequently, in such situations, ewes are liable to be fat during the whole season, and this is neither advisable nor economical. Immediately after weaning, the ewes are put on to dry and poor pasture, — firstly to dry up their milk, and, secondly, for the sake of economy. This is done about the middle of May, or first week of June; but the exact period varies. The lambs are best weaned when from nine to ten weeks old. The ewes are frequently run over the grass-land, being employed to eat down

the ley lands bare that are intended for wheat. They are thus kept until within a month of the time that the ram is put among them, when, if necessary, they are placed upon somewhat better keep, so as to freshen them up a little. It is considered that this insures a better crop (as it is often called) of lambs than if the ewe conceives while in poor condition. This brings us to September or October, according to the system adopted. In the case before us, the 25th of September is a very frequent time. The rams are selected with a view to correcting any faults of the flock, and generally of improving it; and one ram is sufficient to impregnate sixty ewes, although a greater number are often allotted to each ram. Ram lambs are occasionally employed, especially in Hampshire Down flocks; but yearling and two-year-old rams are more ordinarily used. The proper age to place a ewe in the flock is eighteen months, or the autumn after she is one year old, and, as a general rule, she remains in the flock three years, when she becomes a cull. There are advantages in 'culling' the ewe flock 'close,' or keeping it young, as by so doing the cull ewes will fatten more readily at home, or command a higher price if sold for breeding purposes. It is the object of the flock-master to keep his ewe flock young and vigorous, as well as to improve it as a breeding stock. To this end the flock is weeded, not only of old ewes, but of all defective animals, and, as far as possible, a uniformity of type is secured throughout the flock. After the ram is removed, the ewes are run upon old seeds, stubbles, and grass-land, until late in the year. No limit of time can, indeed, be fixed; for, should the weather remain open, ewes will do much better upon such keep than folded upon roots."

The space allotted to agriculture will not permit a consideration of all the subjects interesting to farmers; but we have endeavored to give accurate and authoritative information concerning the larger general interests to which scientific investigation has been directed, and concerning which the general farmer most needs advice.

SWINE.

Pork can be produced with profit by Eastern as well as Western farmers if they will only learn the simple principles of successful hog-raising. Good pigs are always in demand.

The step of chief importance is to obtain a sow of good breed and a thoroughbred boar; for a well-bred pig will yield, as a result of the consumption of a given amount of food, twice as much meat as a pig of poor breed. One litter of pigs will pay the difference of expense in obtaining first-class breeders instead of the ordinary specimens.

We consider the "Chester White" nearer perfection than any other hog, though the "Berkshire" is larger, an excellent breeder, and fattens well. The "Suffolk" and the improved "Prince Albert Suffolk" are also good breeds; while the "Poland," "Leicester," "Cheshire," and "Essex" are better than ordinary.

Breeding. — The breeding-time is between fifteen and seventeen weeks.

Two litters of pigs should be produced from one sow, each year, in such seasons that the pigs will not be subject to cold weather until they have acquired good strength and settled habits of feeding. If, at the end of the fourteenth week the sow appears to be suffering or restless, entice her into a sty by herself. This sty should have cleats about the sides, about a foot from the floor, at such a distance from each side that the pigs can, by running under them, escape being crushed by the sow. They need to be carefully watched for some days, lest they receive injury from the sow; and the after-birth should be removed as soon as dropped. For a few weeks before and after farrowing the sow should be fed on cooked meal and milk, and turned into a grass plat, at least an hour each day. In ten or twelve days after birth the pigs can be let out with the sow; and at this time should be taught to eat warm milk and bran, from little troughs under the side-rail of the sty, out of reach of the sow.

Whole grain should never be fed to hogs; and meal, of whatever kind, should always be cooked.

A quart of oatmeal, boiled with cut hay or cornstalks, and diluted to make a pailful of easily stirred material, makes a good meal for a hog.

MEDICAL

HISTORY OF MEDICINE.

THE origin of medicine is obscure, notwithstanding much time and labor have been spent in endeavors to determine it. SCHULZ, who was professor at Altorf in the beginning of the eighteenth century, endeavored to trace it back to Adam and Eve. That our first progenitors, when hurt or unwell, employed such applications to relieve themselves as their instinct or reason suggested, may be admitted; but in this they did not much differ from a dog, which, when sick, eats grass; and we might as well, therefore, trace the origin of medicine to the brute creation.

ISIS and OSIRIS of the Egyptians, and HERMES of the Greeks, seem to have been worshipped in the early ages as the gods of medicine.

Herodotus tells us that the Babylonians and other nations had no physicians, and that the method pursued was to expose the sick by the wayside, that passers-by who had suffered from similar maladies might recognize them, and declare the means of cure. But later, in Egypt, the sick were required upon recovery to go to the temples and record on tablets their symptoms and remedies. The temples of Canopus and Vulcan were the repositories of these records.

A skilled priesthood finally arose, which framed a code controlling public hygiene, individual regimen, and the treatment of disease.

The early medicine of Greece is legendary.

ÆSCULAPIUS was the great luminary of the Grecian period. Pindar tells us, in the third Pythian ode, that he was the son of Coronis and Apollo, and was nearly sacrificed to the vengeance of the gods; but Apollo snatched him from the funeral pile and carried him to a remote and secure cave, the retreat of Chiron, a centaur, that he might learn to cure the manifold diseases that afflict mortals. He treated with success many who consulted him; but, owing to his imprudence in restoring a dead man to life, he incurred the displeasure of Pluto, and was stricken with a thunderbolt from Jove. He became the god of the healing art, and temples were erected to his honor. Two sons survived him, and are mentioned by Homer in his Iliad, and four daughters. HYGEIA was one of these daughters, and was worshipped as the goddess of health.

Medicine in its primitive state comprised a recognition of the relative value of different articles of diet, and a use of medicinal herbs and roots, and also of superstitious rites. Superstition ascribed disease to evil spirits, or displeased divinities.

Æsculapius.

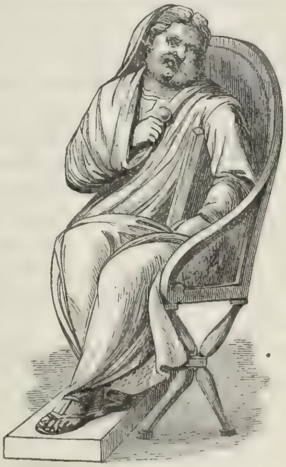
Hippocrates, the great father of medicine, was born in the island of Cos, on the southeast coast of Asia Minor, during the year 460 B.C. It was through his influence that medicine as a science became established, and disease was shown not to be the baneful act of some incensed god or goddess, but the result of some physical cause. He believed that in the body there were four humors, "black bile," "yellow bile," "blood," and "phlegm," and that disease arose from a deficiency or misproportion of them. In consequence of this belief, he seems to have used violent purgatives, hellebore being one of his favorites.

Diocles, the most celebrated successor of Hippocrates, disputed this theory of disease; but the theory he substituted in its place was equally fallacious. In place of the four humors he divided the body into four portions. He says, "When a disease is about to fix in the head, it is usually announced beforehand by vertigo, pain in the forehead, heaviness of the eyebrows, noise in the ears, and throbbing in the temples," etc. He advised, when such symptoms arose, that the patient should gargle with a mixture composed of hops, hyssop, and sweet-marjoram. If this was his treatment for a case of meningitis, the cure must have been effected by diet and nature, and not by the assistance of his remedies.

Asclepiades was another physician of great renown, who lived about the same period, born in Bithynia. After practising awhile in Alexandria, he finally settled in Rome. He believed the body was formed out of corpuscles which were endowed with power of motion, and out of the action or reaction of these arose the vital phenomena of life and health, while the imperfect performance of their functions produced disease and death. Rejecting the Hippocratic theory of disease as regards the humors, he abandoned the practice founded on it, and maintained that the administration of powerful drugs, instead of expelling the evil from the body, induced an unnatural condition. He trusted much to diet, and the proper use of friction and exercise, for the performance of cures.

Aurelius Cornelius Celsus was a celebrated Roman physician who lived in the reigns of Augustus and Tiberius. He selected from the opinions and practice of his predecessors and contemporaries those of the greatest soundness, but did not himself bring forward any dogmatic theories as to the cause of disease. By this judicious selection, he greatly advanced the medical science.

Galen is the next to appear, and is probably better known in connection with medicine than any other man. His influence has been enormous, extending paramount over a period of fifteen hundred years. He was born A. D. 131, at Pergamos, a town in Asia Minor; studied



Galen.

anatomy for some time in Alexandria; and returned to his native town at the age of twenty years. He became physician to the temple of Æsculapius, where he remained until the age of thirty-four, when, in consequence of some political disturbance, he left Pergamos and went to Rome. He, however, returned to his native place, where he is supposed to have lived to the age of seventy years.

It is said he wrote three hundred volumes, the greater part of which were burned in the Temple of Peace at Rome, where they had been deposited.

Among other studies Galen devoted some time to investigating the cause of disease; and the classification which he adopted is used at the present day. His theory as to the cause of disease was somewhat ethereal: he supposed it was due to some disturbance of the *pneuma* or spirit which governed the being. This spirit, however, was different from the soul, which he believed resided in the brain.

Shortly after Galen's time medicine degenerated, and superstition again invaded the natural course of its teachings. The belief of the efficacy of charms in giving power to inert substances was almost universal, and in fact continued for the whole of the first fifteen centuries of the Christian era, and may be said even to the present day to be believed in by the ignorant and superstitious. Galen himself, although bravely opposed to this degrading superstition, was not altogether free from it; for he says, "I once knew a boy who was never seized with epilepsy after he carried a large piece of peony appended from his neck."

ALEXANDER OF TRALLES, one of the most distinguished physicians of his age, gives minute details in regard to the use of amulets.

This physician, who lived about the fifth century, recommends, as one of the most efficacious remedies for epilepsy, "the nail taken from the arm of a malefactor who had been crucified." For the cure of colic, he recommends "the use of a stone on which the figure of Hercules killing a lion is engraved"; besides a verse of Homer and a gold plate, on which the following words in Greek were to be written: "When the moon was waning."

If such was the practice of one of the foremost men of his age, we leave to the imagination what must have been the proceedings of the ignorant and vulgar practitioners of medicine of that time.

The decline of medicine during the dark ages of Europe was doubtless due, to a great extent, to the violent laws brought into force, and under which a physician's life seems to have been one of trial and tribulation.

We cannot more effectually delineate the state of affairs at this period than by quoting one of the laws by which the practice of medicine was restricted, and which was in general force over Europe until the eleventh century: "If a physician injure a nobleman by blood-letting, he shall pay a fine of a hundred solidos; but, if the nobleman die after the operation, the physician shall be given up to his relatives, to do with him as they please."

Although medicine declined in Europe, it was pursued and advanced by the Arabian schools, which flourished from the ninth to the fourteenth centuries. Symptoms were studied and new diseases described. Galen's works were translated and commentated, rendering famous the names of Rhazes, Avicenna, Avenzoar, Averhoes, etc.; and drawing the students of the whole continent to the renowned Spanish schools of Cordova, Seville, Toledo, and Saragossa.

We give here a few extracts from an old Anglo-Saxon work for the treatment of disease: —

"*For Sleep.* — Lay a wolf's head under the pillow, and the unhealthy shall sleep.

"*For Swollen Eyes.* — Take a live crab, put his eyes out and put him alive again into water, and put the eyes upon the neck of the man who hath need; he will soon be well.

"*For Jowl (Jaw) Pain.* — Burn a swallow to dust, and mingle him with field-bees' honey; give him that to eat frequently.

"*For Joint Pain.* — Sing nine times this incantation thereon, and spit thy spittle on the joint: '*Malignus obligavit: angelus curavit: dominus salvavit.*' It will soon be well with him.

"*In Case a Man be Lunatic.* — Take a skin of mer-swine or porpoise, work it into a whip. Swinge the man therewith. Soon he will be well. Amen."

During 1162 A. D., at a council held at Montpellier, a decree was passed forbidding the practice of medicine by the monks. This may be looked upon as the first step in the process of the divorce of medicine from the church; but it took many years for its consummation, for it may be stated that, up to the fourteenth century, nearly all physicians were ecclesiastics.

Until the fifteenth century, nothing else of importance or worthy of note occurred in the history of medicine, except that it was steadily progressing.

About the year 1600, we arrive at a most important period in the history of medicine. This was during the sweating sickness which devastated the greater part of Europe. People had come to distrust their physicians, and physicians their physic. When physicians were piteously implored for aid, they replied that none could be given, because the disease was due to the evil conjunction of the stars.

As there was no help to be got from these medical clergy, and as men will not submit to die like sheep without some effort to save themselves, it naturally happened that there arose a multitude of quacks, who took upon themselves the office left vacant by the physicians. Some amongst them were men of ability in other sciences.

Cardan, born in Pavia, 1501, was the most remarkable of this hybrid between philosophers and quacks. He was one of the most renowned mathematicians of his age.

Another peculiar genius who lived about this time was **Paracelsus**, born 1493 in Germany, who seems to have made quite a commotion by his treatment. He, however, no doubt, was a genuine quack, and it was only through arrogance that his name became so well known; he died in 1541.

Twenty years later the great **Lord Bacon** was born in London. His task was to arouse men from their dreams, and teach them the true method of investigating the natural world.

Although it cannot be said that Lord Bacon personally did much for the advancement of the medical science, yet he must be credited with a large share of the general advancement of the science by the clear and emphatic way in which he pointed out its defects, and laid down the rules for investigation. Bacon tried to impress upon the medical profession the necessity of finding specifics. He says, "Examine minutely the various forms of disease, and adapt to each its own particular remedy." Bacon died in 1626; and twelve years afterwards the Countess of Cinchona, Queen Regent of Peru, was cured of ague by the bark of the cinchona-tree, and by her cure the most striking illustration was given of the truth which Bacon had been uttering all his life, — that medicine was to be improved by the discovery of remedies for the cure of particular diseases.

Harvey and **Van Helmont** were the immediate successors to Bacon; but their careers differed widely, as far as the results of their investigations were concerned.

Van Helmont was born in Brussels, 1577; and William Harvey, at Folkestone, England, in 1578. Van Helmont's system of teaching may be called spiritual-vitalism. He believed that the primary cause of all organism was *archæus*. By archæus, man is much more nearly allied, he says, to the world of spirits and the Father of Spirits than to the external world. Archæus is the creative spirit, which, working upon the raw material of water or fluidity by means of a ferment, excites all the endless actions which result in the growth and nourishment of the body.

While Van Helmont was the exponent of the speculation of his age in the direction of both vitality and chemistry, Harvey proved himself heir to the land of promise pointed out by Lord Bacon in the kingdom of simple observation and direct experiment. It was due to Harvey's labors that the circulation of the blood was made known. This discovery effected a revolution in the medical science, and was for a long time opposed in the most violent manner.

We now come to the period of the history of medicine where the theories expounded were not merely the baseless speculations of an imaginative mind, but the results of actual experiment. The seventeenth and eighteenth centuries were, and even the present time may be said to be, an age of revolution.

Among those who have helped to advance the science may be mentioned the names of *Descartes*, born 1596; *Sylvius De La Boe*, 1614; *Boyle*, the father of modern chemistry, 1627; *Lorenz Bellini*, 1643; *Sydenham*, 1624; *Stahl*, 1660; *Hoffman*, 1660; *Boerhaave*, 1668.

During the eighteenth century appear the names of *Albert Haller*, 1708; *Cullen*, 1710; and *Jenner*.

The name of Jenner will ever be honored as the discoverer of the means of preventing or moderating the most terrible pestilence of modern times.

EDWARD JENNER was born in Berkeley, Gloucestershire, England, in 1749, and died 1823.

EDWARD JENNER.

As is usual in all great discoveries, Jenner was met with bitter opposition; unstinted denunciation and vituperation were heaped upon him and his discovery. The world, however, soon appreciated its vast importance, and now the name of Jenner is enrolled amongst the greatest benefactors of mankind.

In the present century the progress of the medical science has been very great in all directions, but especially in the department of pathology. It may be said that the German school has taken the lead in the science and practice of medicine, and it is from them we derive the most valuable results of recent investigation.

A history of medicine would not be complete which omitted the names of Hahnemann and Vincenz Priesnitz.

SAMUEL HAHNEMANN was born at Meissen, in Saxony, 1755. He was the founder of the school of Homœopathy, which, although contrary to the traditions of the medical profession and opposed to the beliefs of the majority of physicians, has yet obtained a foothold, and has, especially in this country, attracted to itself many disciples. It is a singular fact that Germany, which was the birthplace of this new school of medicine, does not contain at present one university which teaches its doctrines. There can, however, be no doubt that the orthodox school of medicine was influenced to some extent by its teachings, although directly opposed to its general principles.

VINCENZ PRIESNITZ was born at Grafenburg, Austrian Silesia, 1799. He was the founder of the school of Hydropathy, although it cannot be said that the theory of hydropathy was original with him. The water-cure had previously been written upon by two English physicians, whose works had been translated into German and probably suggested to him the new doctrine. The teachings of hydropathy have not been disseminated to any extent, but many of its most valuable points have been incorporated into the allopathic practice.*

We cannot close this article without mentioning with due honor the name of *Hunter*, *Bell*, *Bichât*, *Barthez*, *Pinel*, *Rasori*, *Abernethy*, *Rush*, *Hosack*, *Laennec*, *Broussais*, *Louis*, *Liebig*, and *Virchow*, all of whom have assisted in the advancement of the healing art.

HUMAN PHYSIOLOGY

IS the science which treats of the life of man. The human body may be viewed as a machine, though infinitely surpassing the most perfect work of men's hands. It stands alone in this respect, that within itself exists the power of growth and preservation, converting by a subtle chemistry every form of organized matter into its own tissues. This assimilating and constructing power is called vitality; but we are profoundly ignorant what this power is. We will in these pages give an outline of the structure and functions of the different organs, and show the injurious effects caused by their imperfect action. So close, however, is the connection existing between the several parts of the frame, that the disease of one affects another, until all are more or less influenced.

THE BRAIN AND NERVOUS SYSTEM. — The *brain* is the great mass of nervous substance which occupies the cavity of the skull. It is somewhat oval in shape, and is divided into two halves by a deep furrow which runs longitudinally across it; but the two hemispheres are joined together at the centre by a band of nerve fibre called the *corpus collosum.* It is also separated by transverse furrows, and by certain differences of structure, into three principal divisions; namely, the *cerebrum*, the *cerebellum*, and the *medulla oblongata.*

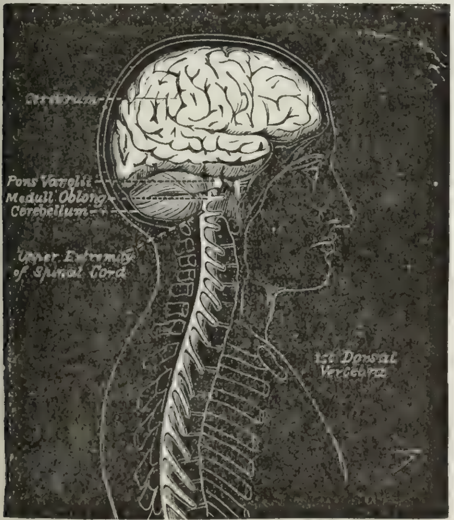


FIG. 1. — The Brain and Spinal Cord.

The CEREBRUM is by far the largest division of the brain, and it overlaps all the other parts, in front, above, and behind, occupying, in fact, all the upper cavity of the skull. Its outer and upper part are formed of gray matter arranged in numerous folds or convolutions, separated from each other by depressions of various depths. The number and depth of these convolutions appear to bear a close relation to the intellectual powers of the individual, as they are much more numerous and deeply marked in the higher grades of social development than in the lower.

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* The term "Allopathic" is somewhat modern: it was given to the Hippocratic or orthodox school of medicine, in contradistinction to "Homœopathic." It is derived from the Greek *allos*, another, and *pathos*, disease; and means a mode of curing diseases by producing a condition of the system *opposite* to that essential to the *disease*.

The *cerebrum* is considered to be the seat of the special faculties of the mind, — reason, judgment, memory, and all the intellectual operations. The evidences that the cerebral hemispheres have these functions are chiefly these : —

1. That any severe injury to this part of the brain may instantly deprive a man of the power of manifesting any mental faculty.

2. That, when it is deficient, there is a corresponding absence of mental powers.

3. That in proportion to the development of the higher mental faculties, the greater is the size of the cerebral hemispheres compared with the rest of the cerebro-spinal system.

The CEREBELLUM, or little brain, is situated beneath and behind the cerebrum. It is divided into two lateral halves, which are connected together by a bundle of fibres. called the *pons varolii.* The cerebellum is believed to be the special seat of the purely animal functions, and that its office is principally that of regulating and combining muscular movements.

The MEDULLA OBLONGATA is the expansion of the spinal cord after its entrance into the cranium. It is a widened oblong mass, situated below the cerebellum, which still preserves the general external appearance of the spinal cord. Its function is to collect and communicate to the higher organs the sensations conveyed by the nervous organization. It also particularly presides over the process of respiration; for when the medulla oblongata is destroyed, respiration instantly ceases, and life at the same moment comes to an end.

It has been attempted in recent years, by Ferrier and other physiologists, to demon strate, by experiments upon animals, the different functions of the various parts of the brain, and the location of the various faculties, but it cannot be said that their theories are satisfactorily established yet.

PHRENOLOGY has also tried to indicate the mental qualities by the external conformation of the skull, but the investigations of physiology do not support its assumptions. Phrenologists have located several important organs upon portions of the cranium which have no direct connection with the brain, and which, therefore, are not likely to indicate the conformation of the brain. The shape of the skull is also frequently altered, as by accidents in childhood or by artificial means, as amongst the Peruvians, without apparently affecting the mental faculties of the individual.

The average weight of the brain in an adult male is forty-nine and a half ounces, and of a female forty-four ounces; but the weight of the brain does not bear any ratio to the mental powers. For instance, Daniel Webster's brain weighed 53.4 ounces, while the brain of a man who had been an idiot from childhood weighed 54.95 ounces.

SPINAL CORD. — The spinal cord is a long, white, cylindrical nervous mass, running from below upwards directly along the middle line of the back, in the cavity of the spinal canal. The substance of the spinal cord is soft and delicate; but it is defended by the bony structure of the vertebræ, which arches over and embraces the spinal cord at the sides and behind, inclosing it in a long cavity or canal, known as the "spinal canal." The spinal cord passes upward through this canal until it reaches the upper extremity of the spinal column, where it enters the cavity of the cranium, expanding at once into the *medulla oblongata.*

The spinal cord, like the brain, is divided into two exactly symmetrical halves, united in the middle, but separated in front and behind by a vertical *fissure* or furrow, which traverses its whole length. The cord is composed of fibrous substance and nerve-cells; the former of which is situated externally and constitutes its main portion, while the latter occupies its central portion. The fibrous part of the cord is mainly formed of the innumerable fibres of the spinal nerves issuing from it or entering it, which assume either a longitudinal or tranverse direction.

The spinal cord acts as a transmitter to the brain of impressions or states of nervous excitement. Through it also the stimulus of the will, supplied by the brain, is capable of exciting the action of the muscles supplied from the spinal cord with motor nerves. There is another important function of the spinal cord, termed the *reflex action*, which will be spoken of under the "Nervous System."

The NERVOUS SYSTEM consists of two portions or systems: 1. The cerebro-spinal, which includes the brain, spinal cord, and the nerves proceeding from them; 2. The sympathetic or ganglionic, which Bichât named the nervous system of organic life. This consists essentially of a chain of ganglia, or small bodies varying in shape and color, connected by means of nervous cords, which extend from the cranium to the pelvis along each side of the vertebral column or spine, and from which nerves proceed to the organs contained in the chest, abdomen, and pelvic cavities.

A *nerve* is white in color, and is made up of,—1st, an external thin transparent membrane, called the *neurilemma;* 2d, a white substance placed under this membrane, which goes by the name of the white substance of Schwan; 3d, the axis cylinder, composed of gray matter, in which resides the power of transmission, the other two portions being only accessory to its isolation, and acting somewhat in the same manner as the silk wrapped around an electric wire.

The CRANIAL NERVES, nine in number on each side, arise from some part of the cerebro-spinal centre, and are transmitted through small openings, called *foramina*, at the base of the cranium. They have been named numerically according to the order in which they pass out of the base of the brain. Other names are also given to them, derived from the parts to which they are distributed, or from their functions. Taken in order, from before backwards, they are as follows: 1st, olfactory; 2d, optic; 3d, motor oculi; 4th, pathetic; 5th, trifacial; 6th, abducent; 7th, facial and auditory; 8th, glosso-pharyngeal, pneumogastric, and spinal accessory; 9th, hypo-glossal.

Many of these nerves will be fully described when speaking of the special senses. The one of the most interest is the *pneumogastric*, from its extensive distribution, and at the same time from its being a compound nerve,—that is, containing both motor and sensitive filaments. It is distributed to the following parts: the pharynx, or the back of the throat; the larynx, or the triangular box placed in front of the neck, in which the vocal cords are situated. Its branches also pass to the lungs, heart, stomach, etc.

Over the vocal cords it has an influence by contracting or relaxing the small muscles that govern them. Should the nerve become injured or divided, the vocal cords become lax and non-vibrating, which results in the loss of the power of utterance. During the Franco-Prussian war, the great French physiologist, Claude Bernard, being asked what could be done to prevent the cattle they were desirous of transmitting across the hostile lines from bellowing, he showed them where the recurrent laryngeal nerve, a branch of the pneumogastric, could be divided. This was done, and the cattle, unable to utter any sound, were transmitted safely across.

The branches of the pneumogastric are numerous in the lungs, and they have the following action: The blood which is brought to the lungs from the right side of the heart contains a larger quantity of carbonic acid than the blood in the left (or arterial) side; this excess of carbonic acid irritates the fibres of the pneumogastric, and the irritation is transmitted to the upper part of the medulla oblongata where the nerve arises, which in its turn stimulates the nerves that induce contraction of the muscles of respiration; the chest thus becomes expanded, a supply of oxygen enters the lungs, and the carbonic acid is expelled with the next expiration. If one of these nerves be injured or divided, the respirations become slow; and, if the influence of both are suspended, death immediately ensues from suffocation, as the stimulus from the impure blood is not transmitted, and consequently the expansion of the chest does not occur.

Over the heart the pneumogastric nerve has a depressing influence, regulating the number of beats. If its branches distributed to the heart be severed, and respiration be continued by artificial means, the heart will beat rapidly and irregularly, showing that these nerves do not cause its contraction, but only regulate the number of beats.

The SPINAL NERVES, so called, take their origin from the spinal cord, and are transmitted through small apertures, called the *intervertebral foramina*, on either side of the spinal column. There are thirty-one pairs of spinal nerves, which are divided into sensitive and motor nerves.

The *sensitive nerves* arise from the back part of the cord, or what is termed the posterior column; and the motor nerves from the anterior column of the cord. Both of these nerves pass out separately from the spinal cord, and join together after leaving the cord, forming one branch. They soon again, however, divide into two branches, one of which passes to the front and the other to the back.

These nerves, after they have joined together, become *compound; i.e.*, they transmit the sensitive as well as the motor influences. Supposing one of these compound nerves were severed, both sensation and the power of motion would be lost; but, if a nerve is severed before its junction, or if that part of the spinal cord from whence they arise is injured or diseased, then only one of the influences is destroyed, — either sensitive or motor, as the case may be. This partial suspension of the nervous functions is often seen in different varieties of paralysis, in some of which only the sense of feeling is lost, and in others the power of motion.

REFLEX ACTION OF THE SPINAL CORD. — In addition to its function of transmission, the spinal cord has also the power of originating influences, or what is termed *reflex action;* that is to say, it has the power of governing certain actions without the mind becoming aware of it, although it is always more or less under the restraint of the will. In the action of walking, for example, as soon as one foot is placed upon the ground, a reflex action is produced by which the muscles of the other leg are contracted and the leg lifted, without any conscious exertion of the will. Again, if any object be suddenly applied to the hand or foot which may cause irritation of the nerves, such as extremely hot or cold substances, the part is instinctively withdrawn before the mind becomes aware of it. A good example of this may be seen in the decapitated frog, in which the influence of the brain is removed. Should its leg be touched with an acid, it immediately contracts; and, if the irritation continues, the foot is lifted and an effort made to brush away the offending substance. This is purely a reflex action, the brain having no influence over the movement. Again, if the finger be placed on some sensitive part, such as the hand of a young child, the finger will immediately close over it, although the child may be asleep and the will-power be dormant.

The SYMPATHETIC SYSTEM, as has been said above, is distributed to the organs situated in the different cavities of the body, and its action is entirely uninfluenced by the will. It is by this system that the organs of the body are made to perform their functions. Thus the contraction of the heart is caused by the irritation of the sympathetic nerves by the passage of the blood through it, which induces reflex action. So, also, when food is introduced into the stomach, the processes of digestion are performed unconsciously to us.

All these actions are performed involuntarily, nor could we exert any influence over them if we wished.

SENSE OF TOUCH. — The sense of touch is not confined to any particular parts of the body, — of small extent, like other senses. But, although all parts of the body are supplied with sensitive nerves, and are thus in some degree organs of touch, yet the sense is exercised in perfection only in those parts, the sensibility of which is extremely delicate; *e. g.*, the skin, the tongue, and the lips, which are provided with abundant papillæ, or touch-corpuscles. By experiment it has been found that the tip of the *tongue* and the point of the *middle finger* are the most sensitive points.

The nerves of sensation are derived from the posterior part or column of the spinal cord which carries this sensation to the brain.

The nerves of sensation arise from the spinal cord, and are distributed to various portions of the body, ending in small elevations (*papillæ*, or touch-corpuscles), which are situated immediately under the *epidermis*, or outer skin. In the hands, fingers, lips, and tongue these small elevations are very numerous.

When a small point is applied to the skin, we feel a pricking sensation: a larger body produces a sense of weight.

If a nerve supplying a special part be cut, the sensation of that part will be suspended. If the end nearest to its origin be irritated, a sensation of pain will be communicated to the brain, as if it were derived from the part to which the nerve is distributed.

In some diseases, as certain kinds of paralysis, the posterior part, where these nerves arise, becomes diseased; and thus the patient, unable to feel when the foot is placed on the ground, cannot tell when the other foot should be lifted. The walk, therefore, is stumbling, accompanied with frequent falls.

The object of sensation is manifold, guarding us against the application of injurious substances and informing us of the consistency and character of objects. The senses of touch and sight are closely allied; thus, by comparison, we are enabled to estimate the size, shape, etc., of objects without actual contact; and the mind, becoming familiar with those shapes by education through the sense of touch, is enabled at a glance to determine what sensations they would produce if handled.

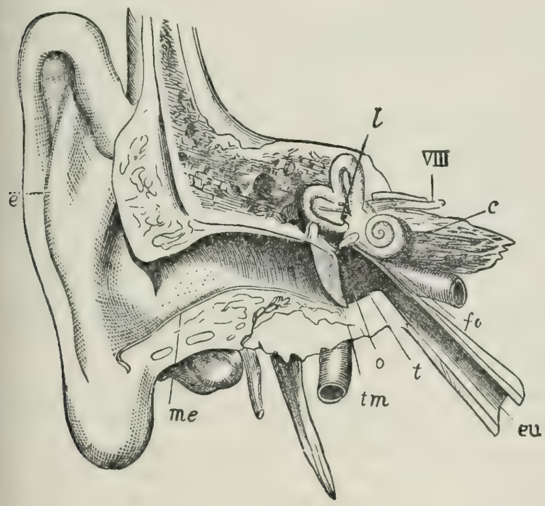


FIG. 2.—The Entire Hearing Apparatus in Man.

e, External ear; me, External auditory passage; l, Bony labyrinth; VIII, Auditory nerve; c, Bony cochlea; fo, Fenestra ovalis; eu, Eustachian tube; t, Tympanum; o, Auditory ossicles; tm, Tympanic membrane.

EAR.—The ear (Fig. 2) is divided into three portions, called external, middle, and internal ear.

The external *pinna*, or auricle, is that expanded portion which we see. It is composed of cartilage and covered with skin. Various parts of it have received different names; as, the *helix*, *concha*, *lobule*, *tragus*, etc.

Extending inwards from this expanded portion, we have a canal, which is called the external auditory canal: it is lined with skin, and about one and one quarter inches in length.

The inner portion is closed by a membrane, semitransparent and tense, and placed at an oblique angle with the canal. This is the drum, or membrana tympani.

On the inner side of this drum is a small chamber, which has received the name of the tympanum, or middle ear.

This chamber is constantly supplied with air by means of a tube (*Eustachian*) passing from it to the back part of the nose. The benefit of air in this chamber is to neutralize the atmospheric pressure from without, which is fifteen pounds to the square inch. This chamber also communicates with the mastoid cells.

The chamber is lined with a membrane called mucous, the same kind of membrane which lines the mouth.

On the inner wall of this small chamber are two small windows, called *fenestra ovale* and *rotunda*, from their shape. These are covered over by the membrane lining the cavity. Suspended across this chamber are three small bones, named, from their shape, the *anvil*, *mallet*, and *stirrup*, which are connected together by ligaments. One portion of the mallet is attached to the drum, and the base of the stirrup fits into the oval window.

If we could enter from this chamber through one of the above-mentioned windows, we should find another small cavity (the *vestibule*), having numerous small passages leading from it, grooved out of the bone.

This small chamber, with its numerous passages, called the *labyrinth*, on account of its complexity of arrangement, constitutes the internal ear, and is the seat of the sense of hearing, the other portions being merely accessory.

In the vestibule there is a small sac, of which there are prolongations through various passages. These passages or canals have been called, from their shape, *semicircular canals* and *cochlia;* the latter so named from its resemblance to a snail's shell, its grooves being twisted. The small sac contained in the labyrinth is filled with a fluid called the *endolymph*. It is on this membranous sac that the special nerve of hearing is distributed. This sac does not completely fill the cavity, but is suspended in another fluid, called the *perilymph*, which occupies the space between this sac and the walls of the canals.

The Physiology of Hearing is as follows: A body struck produces vibrations in the air, called sound-waves; these sound-waves are collected by the trumpet-shaped external ear, which transmits them through the canal running from the external ear to the drum; the drum is set in motion by these waves, and communicates this motion to the small bones suspended in the middle ear. We have seen that one bone is attached to the drum, and another fits into the oval window of the internal ear. The bones, therefore, being set in motion, transmit these vibrations to the fluid contained in the sac in the internal ear, producing undulations or waves in the fluid contained in the sac. These undulations, however gentle, are sufficient to strike the walls of the sac; and the filaments of the auditory nerve, collecting these vibrations, transmit them to the brain. The greater the number of vibrations, the higher is the pitch; the more violent the vibrations, the louder is the sound.

TEETH. — The teeth in man are strong, bony structures, implanted in sockets along the upper and lower jaws. They are intended to fulfil various useful purposes, the most obvious being that of mastication.

In the adult there are thirty-two teeth; viz., sixteen in each jaw. They vary somewhat in shape, and are separated into four classes, according to their shape, and the functions they are intended to perform. The first class are the four front teeth in the upper and lower jaws, comprising eight altogether, called the *incisors*, or "cutting-teeth." These, as their name indicates, are adapted to cutting the food, so far as this is required. Next to the incisors are the *cuspids*, or canine teeth, one on each side of the jaw. They are somewhat pointed in form, and correspond to the "tusks" of the various carnivorous animals, especially to those of the dog, from whence they derive their name of "canines." Their function in man is very similar to that of the incisors.

The third class comprises eight teeth, four in each jaw, called the *bicuspids*, or half-molars. They are situated immediately behind the cuspids, and are furnished with two points. They very much resemble the molars in their function. Situated behind the bicuspids, and at the sides of the jaws, are the *molars*, or "grinders," — three on each side, or twelve altogether, — whose function is the grinding or comminution of food. These have rather a flat surface, covered with small conical elevations. They are provided with three fangs, which penetrate into the substance of the jaw, fixing them strongly, and enabling them to resist the pressure from side to side. The first molars are called the sixth-year molars, because of the time of their eruption ; the second, the twelfth-year molars, for the same reason; and the third, the " wisdom teeth," because they do not make their appearance until the individual has attained maturity.

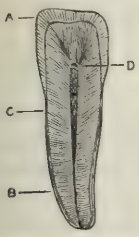


FIG. 3 represents a Central Incisor, split vertically so as to show the various parts. A is the cutting surface, covered, as in entire crown, with enamel; B, the cementum covering the root; C, the dentine; D, the pulp cavity.

A tooth (Fig. 3) is composed of enamel, cementum, dentine, and dental pulp. The exposed part — that above the gum — is called the *crown;* that which is held in the socket, the *root;* and the narrow part between the crown and the root, the *neck.*

The *enamel* is a very hard tissue which encases the crown of the tooth. It is thickest on the cutting edges and masticating surfaces, gradually becoming thinner towards the neck, at which point it is met, or slightly overlapped, by the cementum.

The *cementum* is a layer of hard tissue covering the roots of the teeth. It is intermediate in hardness between dentine and bone, resembling the latter more than either of the other hard tissues found in the tooth.

The *dentine* constitutes the bulk of the tooth, and may be termed its framework, giving each tooth its size and shape. If the enamel and cementum were removed, the dentine would still preserve the general form of the tooth. It is usually highly sensitive both to variations of temperature and to contact with foreign substances, making the excavation of a tooth, preparatory to filling, more or less painful. It owes nearly all its sensitiveness, however, to the pulp of the tooth; and when the pulp dies, the dentine loses almost all of its sensibility.

The *pulp*, commonly but incorrectly called the nerve, occupies a cavity in the centre of the tooth. It is a mass composed of nerves and blood-vessels held together by a cobweb connective tissue. This pulp supplies nourishment to the tooth. It is acutely sensitive, not only to contact with foreign substances, but to variations of temperature. When the pulp dies the tooth loses its brilliancy, the dentine loses its sensibility, and it gradually changes in color. The nerves and blood-vessels which supply the pulp with nutritive material enter through a small canal in the root of the tooth; and, with the exception of this small aperture, the pulp is entirely surrounded by solid dentine.

Eruption of Teeth. — The process known as the eruption of the teeth, or " teething," commences at about the fifth month, and is not completed until about the end of the third year. The first set, called temporary or deciduous teeth, comprises twenty in number, ten in each jaw; and they are usually erupted in the following order in each jaw: —

Two central incisors	5 to 7 months.	Two canines	14 to 20 months.
" lateral incisors	1 to 10 "	" second molars	18 to 36 "
" front molars	12 to 14 "		

The lower teeth usually precede the upper by a few weeks, but there is no absolute uniformity either as to the time or order of the eruption. In each individual case there will probably be some variation from the above statement. The second or permanent set of teeth commence to make their appearance at or about the sixth year, with the formation of the first or " sixth-year " molar. As the permanent teeth approach their full development, a process called absorption sets in, by which the roots of the temporary teeth are gradually removed, until only the crowns remain. Deprived of their support in the sockets, and retaining only a slight attachment to the gums, they are pushed out by the movements of the tongue, or are picked out with the fingers.

The following is the average time and order of the eruption of the permanent teeth: —

First molars	5 to 6 years.	Second bicuspids	10 to 11 years.
Central incisors	6 to 8 “	Canines	11 to 13 “
Lateral incisors	7 to 9 “	Second molars	12 to 14 “
First bicuspids	9 to 10 “	Wisdom teeth	17 to 21 “

This, however, is liable to considerable variation in exceptional cases, both as to time and the order of eruption.

Care of the Teeth. — The first rule for the preservation of a perfect set of teeth is that of cleanliness.

Children, as soon as they are able to use a brush, should be taught to clean their teeth regularly every day, or even twice a day, — morning and evening; and this should be an invariable habit throughout life. Uncleanliness of the teeth is not only a disfigurement to the comeliest face, but it is also a source of the early and rapid decay of the teeth. The accumulation of tartar about the teeth, the retention of food and other matter in their depressions and in the intervals between them, there to undergo fermentation and decomposition, are the principal exciting causes of diseased gums, loosened teeth, and decay. It follows, therefore, that such deposits should be removed before they have had an opportunity to work mischief.

Much injury is also caused by the use of unsuitable brushes and of improper washes and powders. The brush should be fine and soft, with the hairs evenly and closely set. It should never be hard, or too large to conveniently brush both the inside and the outside of the teeth. A safe and usually efficient powder is precipitated chalk and a little powdered orris-root. If this is not found sufficient to prevent the staining and discoloration of the teeth, a small quantity of very finely powdered pumice-stone may be combined with the chalk.

In those cases of *soft, spongy gums*, which bleed at the slightest touch, there is perhaps no better wash than phénal sodique, a preparation made from tar. It checks excessive bleeding, corrects unpleasantness of the breath from decayed teeth or unhealthy secretions of the mouth, and also acts as a valuable agent in correcting acidity and preventing putrefaction. It may be used, according to conditions, more or less, from half a teaspoonful to a tablespoonful diluted in a tumblerful of water. Ordinary salt and water, or a few drops of myrrh in water, is also used for tenderness of the gums, and is frequently sufficient for the purpose.

Tartar on the Teeth. — This is a deposit of animal and earthy matters contained in the saliva which forms upon the teeth, especially during an impaired state of the general health. It is usually yellowish in color, but its color is not uniform, and it may be black, brown, green, or nearly white. It is sometimes of a flinty hardness, and at other times it is so soft that it may be scraped off with the finger-nail. The tartar should never be allowed to accumulate, as it not only may result in the destruction of the teeth, but it also produces inflammation and sponginess of the gums, causing them to bleed at the slightest touch; makes the breath offensive, and vitiates the fluids of the mouth, so that irritation of the throat, indigestion, and even general derangement of the health, may be occasioned.

The accumulation of tartar on the teeth may usually be prevented by proper care of the teeth and frequent brushing; but when an extensive deposit has already formed, it will best be treated by a competent dentist.

Decay of the teeth, or caries, usually commences in the dentine, immediately below the enamel, a yellow or brown spot on the surface of the tooth being its indication. The tissue soon becomes softened and a cavity is formed, which, by the decay of the substance of the tooth, gradually extends inwards until the pulp cavity is reached. The pulp becomes inflamed and suppurates, until, by degrees, the pulp is destroyed by ulceration.

Caries is not only a common cause of toothache, but frequently gives rise to obstinate headache, pain in the ear, deafness, and other disagreeable symptoms. The only remedy for caries is to have the cavity filled as early as possible by a dentist, which will arrest the decay.

Toothache may arise from various causes, and its treatment will depend greatly upon the cause. It may be occasioned by decay, by inflammation of the membrane covering the fang, or the pain may be neuralgic, or there may be other causes. It is therefore impossible to state any general remedy for it; but we give below some means for obtaining relief.

In cases of decay, a mixture of collodion and carbolic acid, which forms a jelly-like compound, put into the cavity of the tooth under a little cotton, will frequently give immediate relief; or a particle of wool saturated with a drop or two of creosote, and thrust into the cavity with a needle. Where there is inflammation, relief may be obtained by applying camphorated chloroform, which may be obtained at any druggist's. For permanent relief, the only efficient plan is to secure the services of a dentist.

THE EYE is contained in the cavity of the skull called the *orbit.* This position secures it from injury, while it at the same time insures an extensive range of sight. The eye is spherical in shape, about one inch in diameter, and is moved in all directions by six muscles attached to it.

The ball of the eye has three coats,—I. Sclerotic; II. Choroid; III. Retina. The sclerotic, or outermost covering, is dense in structure and white in color. The choroid, or middle coat, has numerous blood-vessels, and is of a chocolate color, from the quantity of pigment contained within its cells. The third coat, or retina, is merely the optic nerve, which pierces the two outer coats, spreading out and intermixing with the nerve-cells, forming a thin membrane on the interior surface of the choroid. This internal coat, or retina, is where the images of external objects are formed. The retina and choroid do not extend entirely around the eye, but are folded inwards in numerous plaitings, arranged in a circle behind the iris and around the margin of the lens, forming what is known as the *ciliary process.*

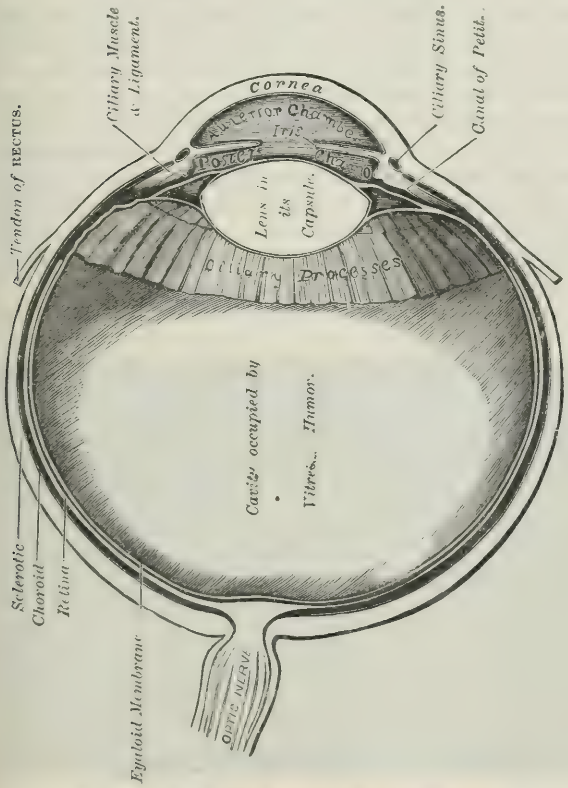


FIG. 4.—A Vertical Section of the Eyeball (Enlarged).

In looking at an eye, the first thing observed is the iris, or colored portion. This is placed under a glassy transparent surface called the *cornea,* which is a continuation of the sclerotic coat that here becomes transparent. The cornea bears some resemblance to the glass over the face of a watch. The *iris* is composed of muscular fibres arranged in two different ways,—one group of fibres running from the circumference to the centre, and another group running circularly around the pupil, and acting somewhat as a string passed around the mouth of a bag. The pupil is an aperture piercing the iris, which, by its dilation or contraction, governs the amount of light admitted into the eye.

Behind and in front of the iris are two chambers, called the anterior and posterior chambers, filled with a transparent fluid known as the *aqueous humor:* this humor is little more than ordinary water holding in solution certain alkaline salts, the principal one being sodium chloride, or common salt. Next in order is the *crystalline lens*, which is situated behind the iris. This is the most important member of the organ of sight, for without it only light and color would be transmitted. The lens is biconvex in form, and resembles a small glass bead flattened and tapering off at its circumference. It is held in position by a transparent membrane called the capsule, to which is attached a small muscle known as the ciliary, which by contraction tightens the capsule and lessens the convexity of the lens, or the reverse, thus adjusting its focus to near or distant objects.

Behind the crystalline lens is a large chamber, forming four fifths of the entire eye, which is filled with a transparent substance, of the consistency of jelly, called the *vitreous humor:* it is glassy in appearance, whence it derives its name. It is the presence of this humor which gives rotundity to the eye, and which prevents it from collapsing.

Phenomena of Vision.—As has been said above, it is only by means of the crystalline lens that we are enabled to perceive the outline and form of things. The *retina* itself is only sensitive to the impressions of light and color; that is, it can perceive the difference between light and darkness, and between the various colors, as red, green, yellow, etc.; but it has no power by itself of distinguishing the *form* of objects. A "lens" is any transparent body having the figure described above,—that is, rounded on its two opposite surfaces and thinner at its edges,—which has such an action on the rays of light passing through it that it brings them together, or concentrates them at a certain distance beyond. The spot at which a lens will thus concentrate the light passing through it is called its *focus*, and the influence of the lens upon the rays is known as the *refraction of light.* The accompanying diagram will enable us to illustrate this refraction.

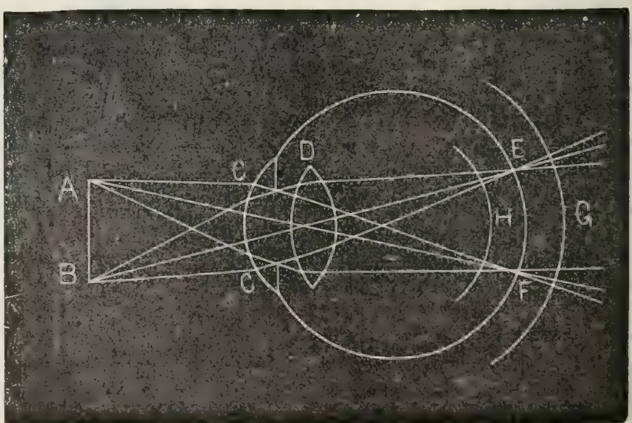


Fig. 5.—Diagram of the Eye.

Rays of light reflected from points A, B, pass through the cornea (C), and are slightly refracted inwards. Upon entering the crystalline lens (D) they are still further bent, until at length these lines, meeting together at one point, form the focus (E, F). It will be observed that the highest point becomes lowest, and *vice versa;* or, in other words, the object is inverted. In the normal eye the point of meeting, or focus, of the lines is just on the retina, or inner lining of the eye. Should the posterior wall be too close to the crystalline lens, the lines would not have met; therefore the vision would be confused, as on the line H. Should the retina be at the line G, the rays, having come to a focus at E, F, will again diverge, and will thus result in an imperfect vision. In some ocular troubles, such as short and far sightedness, the convex portions of the eye (viz., the cornea and lens) which refract the light are either too convex or not sufficiently so, and thus the image is imperfectly reproduced on the retina. In order to rectify these defects, convex or concave glasses are used. Thus in myopia or near-sightedness, which is caused by too great convexity of the lens, concave glasses are used; and in far-sightedness (presbyopia), which is from a directly opposite cause, convex glasses are needed. In this way the correct focus is adjusted, and the abnormal conditions rectified.

When an excess of light falls on the retina, and obliquely to the point of vision, the superfluous rays are absorbed by the pigments of the choroid coat. Otherwise an excess of light falling on the retina would again be reflected, blurring the distinctness of the vision.

In the disease known as *cataract* the crystalline lens becomes cloudy and opaque, and the light cannot enter. It is the removal of this body that constitutes the operation for cataract. After the removal of the lens, only light and color can be perceived; but, by properly adjusting a convex glass, the outlines of objects will again become visible.

Field of Vision. — There is only a small space in front of the eye in which objects can be seen distinctly. As the pupil will not admit rays of light coming obliquely from various directions, there is therefore a field or circle of a certain size within which objects can be perceived. This space is called the *field of vision;* and beyond its limits nothing can be seen, because rays of light coming directly from the side or behind cannot enter the pupil.

But even within this field there is only a single spot in its centre at which objects can be seen distinctly. Thus, if we stand in front of a row of upright poles, we can see those directly in front of the eye with perfect distinctness; but those placed at a little distance on each side are only perceived in a confused and uncertain manner. We can see that they are there but we cannot accurately distinguish their outlines. It is only by the rapid movements of the eye, which is acted on by the muscles, that different parts of a landscape are brought into the direct line of vision; and before one fades another is brought into view, and thus we appear to see the whole. The vision on the retina lasts one eighth of a second. Thus it is that, suddenly seeing a horse in rapid motion by a flash of lightning, it appears to be stationary; for the reflection of light being so short, it is reflected from only one point. Again, if a piece of wood with its end in combustion be quickly whirled around in a dark room, it seems to be one continuous wheel of fire, because the reflection from each point lasting one eighth of a second on the retina, a whole circle of these is formed before the first has faded.

The *Eyelids* are two horizontal curtains or screens in front of the eyeball, which open and shut to admit or exclude the light. The upper eyelid is much the larger and more movable of the two; and, when the eyes are open, it is raised by a muscle attached to its upper edge, and drawn in beneath the roof of the orbit. The inside of the eyelids is lined by a thin and transparent membrane, called the *conjunctiva*, which also extends over the whole exposed portion of the eyeball. The conjunctiva is supplied with a very important watery excretion, by which its surface is constantly bathed, and its brilliancy and transparency kept unimpaired. The tears consist of this secretion. They are produced in a little gland, termed the *lachrymal gland*, situated in the upper part of the orbit, and are conducted thence by a number of fine ducts, which open upon the conjunctiva near the outer corner of the eye.

About five or six times a minute the tears are spread over the surface of the conjunctiva by the act of winking. This motion is performed by means of an oval-shaped muscle situated immediately beneath the skin of the eyelids, which by its contraction suddenly draws the eyelids together; and, as they instantly separate, they distribute the tears in a thin layer over the surface of the conjunctiva.

This motion is very important; for, as the front surface of the eye is constantly exposed to the air, it loses its moisture by evaporation, and would soon become dry, opaque, and wrinkled. It is for this reason that, immediately after death, the eye becomes dull and tarnished, and loses its natural appearance of brilliancy. But during life the *orbicularis muscle* is constantly watching for the safety of the eyeball; and every few seconds it brings the eyelids together with a quick, sharp motion, thus spreading the watery fluid over the surface of the cornea. The motion of winking is a reflex action, — that is, it takes place, as a general rule, without our knowledge, and it is even difficult to resist it by any voluntary effort for any length of time.

The *lachrymal glands* are very sensitive to peculiar mental emotions. These emotions, by the sympathetic action of the nervous system, sometimes excite the glands to unusual activity, so that they pour out their secretion in increased abundance; and the tears, thus discharged in excessive quantity, run over the edge of the eyelids and trickle down upon the cheeks and face. This is the act of weeping.

Care of the Eyes. — The eye is the most delicate and sensitive organ of the body, and special care should be taken that nothing is done which induces early decay of its powers. At a recent sanitary convention at Ann Arbor, Michigan, Dr. C. J. Burdy, of Detroit, read a paper on "Hygiene in Relation to the Eye," which deserves the widest circulation. He says: "A fruitful source of eye troubles is shown to be the excessive strain upon the muscles and nerves of the eyes due to faulty educational methods, the ill-planned and insufficient lighting of school-rooms, poor ink, and the fine print in school-books, and other causes, which education might correct."

In conclusion, Dr. Burdy lays down the following rules for better care of the eyes: —

1. Avoid reading and study by poor light.
2. Light should come from the side, and not from the back or from the front.
3. Do not read or study while suffering great bodily fatigue, or during recovery from illness.
4. Do not read while lying down.
5. Do not use the eyes too long at a time for near work, but give them occasional periods of rest.
6. Reading or study should be done systematically.
7. During study avoid a stooping position, or whatever tends to produce congestion of the head and face.
8. Select well-printed books.
9. Correct errors of refraction with proper glasses.
10. Avoid bad hygienic conditions, and the use of alcohol and tobacco.
11. Take sufficient exercise in the open air
12. Let the physical keep pace with the mental culture, as weak eyes are most usually observed in those who are lacking physical development.

Another injurious habit amongst a number of persons is trying to read while in horse-cars or trains. This is particularly straining to the eyes.

Should the eyes be weak but not inflamed, bathing them frequently in cold water will be found very beneficial.

Color-Blindness. — Faulty perception of color, or *acritochromacy*, is a defect which appears in most instances to resolve itself into inability to perceive red; and the compound tints suggesting doubtful impressions are those into which red enters to a greater or less extent. Yellow seems to be always appreciated, and blue almost always.

The cause of the defect probably resides, not in the eye itself, but in that portion of the brain to which the impressions of light are ultimately conveyed.

Much attention has recently been given to color-blindness, particularly in reference to safety in travelling. Of many thousand males examined in Europe and this country, about four per cent have been found color-blind. In females the defect is comparatively very rare. There seems to be no cure, or even palliation, of a defect which appears to depend upon a congenital want of appreciative power in the brain itself; although M. Joval, in France, recommends interposing between two glasses a thin layer of gelatine for its relief.

THE TONGUE AND SENSE OF TASTE (Fig. 6). — The tongue is the organ of the special sense of taste. It is situated on the floor of the mouth, and is composed of muscular fibre, blood-vessels, nerves, and glands, the greater portion of it being made up of the *Lingualis muscle*, and is divided into two equal portions by a central raphe or groove. Its apex is free, and its base or root is attached by numerous muscles to the *os Hyoides*, a bone of the throat. It is covered by a mucous membrane, which has projecting from it numerous small elevations, called *papillæ*, on the forepart and sides of the tongue, which are supplied by the *gustatory nerve*. This nerve sends small prolongations into the papillæ, and transmits only qualities of taste proper, which we call "sweet," "bitter," "salt," "sour," etc. The consistency, mildness, etc., of substances, such as solid or liquid, rough or smooth, are transmitted to the brain by the general nerves of sensation, the principal one being the glosso-pharyngeal nerve.

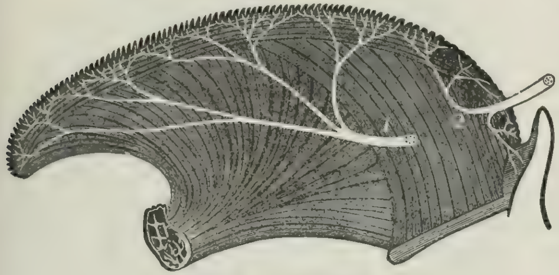


FIG. 6 — The Tongue.

1, Gustatory nerve distributing branches to the papillæ; 2, Glosso-pharyngeal nerve.

The uses of the sense of taste are obvious: it not only contributes to our pleasures, but also serves to indicate such substances as might be injurious if swallowed.

THE NOSE. — The nose, composed of bone and cartilage, is an organ to which the special nerve of smell (olfactory) is distributed. The nasal passages are two canals which extend from the opening of the nostrils in front to the top of the pharynx or throat behind. The two canals are separated from each other by an upright partition, which is situated directly on the middle line and is composed of bone and cartilage: this partition is smooth. The outer walls of these canals have three twisted processes of bone, called the *turbinated* bones, extending from them into the cavity of the canals, and may be compared to shelves. The whole cavity is lined by a mucous membrane called the Schneiderian membrane. The olfactory or special nerve of smell enters the upper part of the nose through many small openings, the portion of bone which admits its passage resembling a sieve. The nerve is distributed to the upper part of the *septum* or partition, to the two upper turbinated bones or shelves.

The object of these shelves is to increase the surface of area for distribution of this nerve. It will therefore be noticed that the sense of smell is located only where the nerve is distributed,—*i. e.*, the upper and back part. Those diseases which by blocking up the forepart of the nose, or increases the thickness of the membrane that lines the nose, diminish the sense of smell; and one of such diseases is catarrh.

The principal object of the sense of smell is to warn us against the inhalation of impure gases and vapors, and to guard us from eating putrescent foods which are accompanied by a disagreeable odor.

Many animals, such as the dog, horse, sheep, deer, etc., have longer noses, and therefore greater surface for the distribution of the nerve, and thus it is that their sense of smell is so much keener than in man.

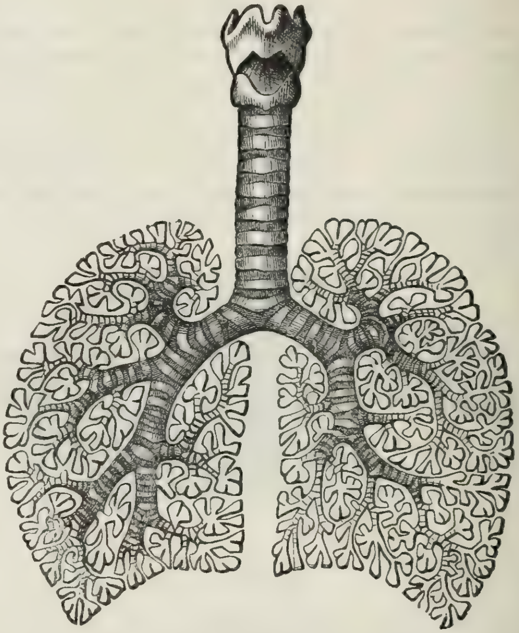


Fig. 7. — The Lungs.

Human larynx, trachea, bronchi, and lungs; showing the ramification of the bronchi, and the division of the lungs into lobules.

LUNGS AND RESPIRATION (Fig. 7). — Oxygen is the first and most essential necessity of existence. Animal life can be supported for some time when deprived of food; but with the deprivation of air, life becomes extinct almost immediately. The atmosphere around us which we breathe is composed chiefly of two gases, oxygen and nitrogen, in the proportion of four parts of the latter to one of oxygen. The oxygen is the life-sustaining element; the nitrogen possessing no active properties, being useful only to dilute the oxygen.

Respiration is the breathing of air into the lungs, and again exhaling it in order to make place for a new supply: the former action is usually called inspiration, and the latter expiration.

The Organs of Respiration. — The *lungs* are two large and very vascular organs, occupying the greater part of the chest, or the uppermost of the two cavities into which the body is divided by the *diaphragm*. The texture of the lungs is somewhat sponge-like; that is to say, they are filled with numerous little cavities, divided from each other by partitions, somewhat like the tissue of a sponge. These little cavities, called *air-cells*, are the terminations of the bronchial tubes, which spread out into numerous branches, becoming smaller and smaller as they proceed.

The cavity of the lungs communicates with the exterior by means of a tube or windpipe. The upper part of this tube is called the *larynx;* the intermediate part the *trachea*, or wind-pipe; and the lower continuations of the trachea, which divides into two lesser tubes leading into either lung, are called the *bronchi.*

The *larynx* has the shape of a triangular box, and is composed of cartilage. It is situated directly at the front of the upper part of the neck, where it forms an angular prominence easily felt by the fingers: it is also sometimes called the "Adam's apple." At its upper part it has a small cover, called the epiglottis, which closes in the act of swallowing, and thus prevents foreign substances from entering it.

The *larynx* is hollow internally, and communicates with the back part of the throat by a narrow chink or crevice called the *glottis.* Through this aperture the air passes from the nostrils and back part of the throat into the larynx.

Below the larynx and connected with it is the *trachea*, a straight rounded tube about an inch in diameter, composed of cartilaginous rings, which run directly down the neck to the upper part of the chest. At its entrance into the chest it divides into two branches, called the *bronchi*, one passing to each lung. The bronchi again divide and subdivide into numerous branches, which are called the bronchial tubes: these tubes continue to separate into still smaller branches, until finally they terminate in small oval sacs or bags, termed the *lobules* of the lungs. The lobules are again divided by membranous partitions into several smaller compartments, and these latter constitute the air-cells.

Spreading through the tissue of the lung, and surrounding each lobule, is a network of capillaries or minute blood-vessels, proceeding from the pulmonary artery: in its passage through these capillaries, the venous blood absorbs the oxygen contained in the air-cells, into which the atmospheric air has been brought by the bronchial tubes, and yields up carbonic-acid gas and vapor in its place, which are exhaled out of the lungs with the next expiration. The blood, with its cargo of oxygen, proceeds through all the tissues of the body, nourishing and reconstructing them, and again returns to the lungs freighted with carbonic-acid gas, to be in its turn emitted through the lungs. It may be remarked that the divisions and ramifications of the interior of the lung serve the purpose of producing a large extent of surface over which the air may come into contact with its tissue. It is estimated by anatomists that the whole internal surface of the lungs, if spread out, would be many times greater than the whole external surface of the skin.

It is calculated that an adult of average size will take into his lungs at every respiration about thirty cubic inches of air. If we count the total number of respirations in a day, including those caused by muscular exertion, the quantity of air that passes through the lungs in the twenty-four hours will amount to 648,000 cubic inches, or about 375 cubic feet.

The movements of respiration are involuntary, — that is to say, they are usually performed without any conscious exertion. *Inspiration* is caused by the irritation of certain nerves about the lungs by the carbonic acid that is brought thither by the blood. This produces a reciprocal movement (termed reflex action), which is transmitted to the muscles of inspiration attached to the ribs, causing them to contract and to lift the ribs: at the same time the large muscular partition that divides the chest from the abdomen (called the diaphragm) contracts downwards, pushing forward the abdominal walls. By these means the cavity of the chest is enlarged, and a vacuum is created between the lung and its walls; the air is then forced inward by the atmospheric pressure from without, passing through the respiratory tubes and expanding the lungs. The lungs are then, like a large rubber bag, distended by the pressure of the air; its elasticity again causes it to close together or contract, and, the muscles at the same time relaxing, expel the air from its cells. This is called the movement of *expiration.*

The respiratory channels are lined by the mucous membrane, and the lungs are covered by a membrane called the *pleura*. It is the inflammation of these membranes that produces the various disorders called pleurisy, bronchitis, etc.

Sighing. — This arises from nervous exhaustion, and is produced by a prolonged inspiratory effort by the diaphragm and other muscles concerned in respiration. The air passes almost noiselessly in through the vocal cords, and, by the elastic recoil of the chest-wall, is rather suddenly expelled again.

Hiccough is due to some slight irritation of the nerves of the stomach. It resembles sighing in that it is an inspiratory act; but the inspiration is sudden instead of gradual, from the diaphragm acting suddenly and spasmodically. The air, therefore, suddenly rushing in through the unprepared *rima glottidis*, causes vibration of the vocal cords and the peculiar sound.

Coughing is produced by irritation of the nerves distributed to the lungs or windpipe. The mechanism of coughing is as follows: There is first an inspiration, and, instead of the air being easily let out again through the glottis, the vocal chords become momentarily approximated and close the upper part of the windpipe. The abdominal muscles, acting strongly, push up the organs contained in the abdominal cavity against the diaphragm, and thus make pressure on the air contained in the lungs, until its tension is sufficient to burst open noisily the vocal cords which oppose its outward passage. In this way a considerable force is exercised, and mucus or any other matter that may need expulsion from the lungs or windpipe is quickly and sharply expelled by the out-streaming current of air.

Sneezing results from irritation of the nerves of the nose. Its act is similar to that of coughing, with this exception, that the air passes out through the nose, and any offending matter is thence expelled.

Vomiting is due to some irritation of the nerves distributed to the stomach, by direct irritation of substances in it. This nervous irritation is often augmented by certain blood conditions, as seen in fevers, pregnancy, etc. In the act of vomiting, as in coughing, there is first an inspiration, the glottis or vocal cords become closed, and immediately afterward the abdominal muscles act strongly, but here occurs the difference in the two actions: instead of the vocal cords yielding to the action of the abdominal muscles and allowing the air in the lungs to escape, they remain tightly closed. Thus the diaphragm, being unable to go up, forms an unyielding surface against which the stomach can be pressed, which results in expulsion of its contents.

Speaking. — This is a voluntary expulsion of air through the glottis or vocal cords, by means of the abdominal muscles; at the same time the vocal cords are put, by the muscles of the larynx, in a proper position and state of tension for vibrating as the air passes over them, and thus producing sound. The sound is moulded into words by the tongue, teeth, lips, etc.; the vocal cords producing the sound only, and having nothing to do with articulation.

Singing resembles speaking in the manner of its production; the laryngeal muscles, by variously altering the degree and position of tension of the vocal cords, producing the different notes.

THE HEART (Fig. 8). — The heart is a hollow, muscular organ, placed between the lungs, and enclosed in a cavity called the *pericardium;* it is placed obliquely in the chest, extending from the right side of the breast-bone to two inches below and one inch to the right of the left nipple, where the apex-beat is felt.

The size of the heart is a little larger than the closed fist, and weighs from ten to twelve ounces in the male, and in the female eight to ten ounces. The heart is divided by a longitudinal muscular par-

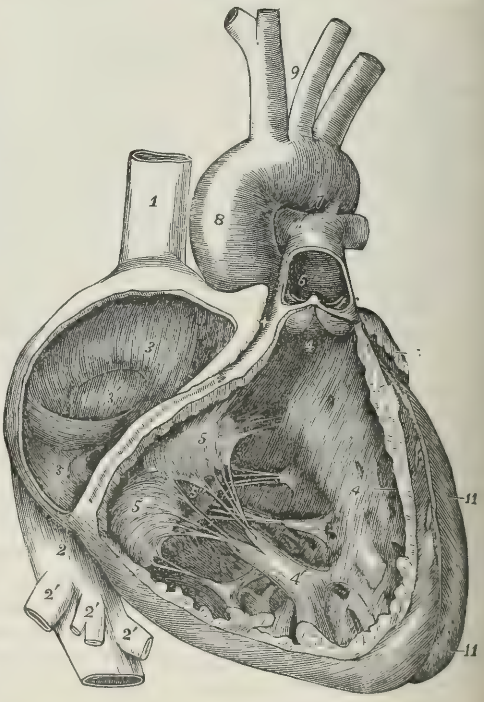


FIG. 8. — The Heart.

1, Superior vena cava; 2, Inferior vena cava; 2′, Hepatic veins cut short; 3 and 3′, Right auricle; +, +, Placed in the auriculo-ventricular groove; 4, 4, Cavity of the right ventricles, the upper figure is immediately below the semilunar valves; 4′, Large columna carnea, or musculus papillaris; 5, 5′, 5″, Tricuspid valve; 6, Placed in the interior of the pulmonary artery; 7 and 8, Aorta; 9, Branches of the aorta; 10, Left auricle; 11, 11, Left ventricle.

tition into two parts, called the right and left heart. Each of these is again divided into two cavities by what are called *valves*, making four cavities in all. The two upper cavities are named the auricles, and the two lower the ventricles. All these cavities are lined by a membrane called the *endocardium*.

The heart contains four sets of valves, — *tricuspid*, between the right auricle and right ventricle; *bicuspid*, between the left auricle and left ventricle; and the two *semilunars*, guarding the aorta and pulmonary arteries arising from the right and left ventricle. The valves between the auricles and ventricles open into the ventricles, and have attached to their free margins little thread-like tendons, which are again attached to the walls of the ventricles. The semilunar valves open outward from the ventricles. The action of the valves is described under the head of "Circulation."

Circulation. — The blood is collected from the veins and discharged into the right auricle by two large veins called the superior and inferior *vena cava.* As soon as the auricle becomes filled with blood it contracts and forces it into the right ventricle, which expands simultaneously with the contraction of the auricle. As soon as the blood has entered the ventricle, the latter in its turn contracts, and in its contraction closes the valves between the auricle and the ventricle, thus preventing the reflux of blood into the auricle. The blood next passes from the ventricle into an elastic tube called the pulmonary artery, which conveys the blood to the lungs. This artery has at its entrance three semilunar valves (so called from their resemblance to half-moons) which open upwards into the cavity of the vessel. Thus, when the blood is expelled from the ventricle into the pulmonary artery, the valves are forced open outwards, and are again closed by the pressure of the blood which has a tendency to return into the ventricle.

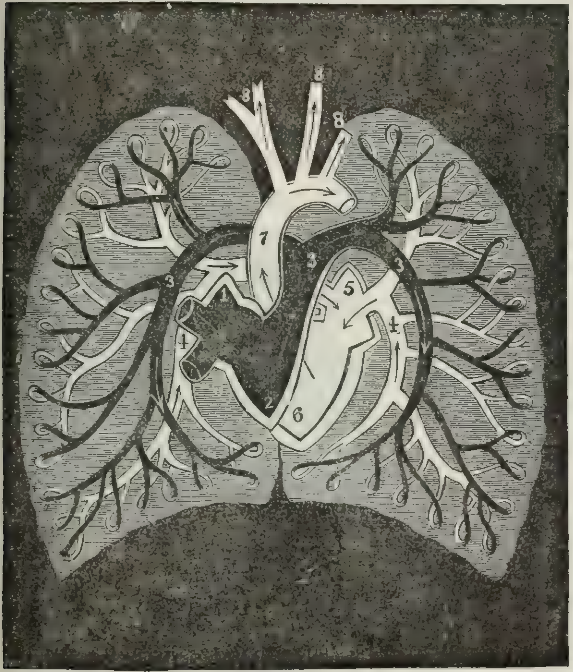


FIG. 9. — Circulation through the Heart and Lungs.

1, Right auricle; 2, Right ventricle; 3, Pulmonary artery; 4, Pulmonary veins; 5, Left auricle; 6, Left ventricle; 7, Aorta; 8, Branches of the aorta.

A very simple illustration of this action would be to force water into a rubber tube; it would be observed that, as soon as the force ceased to be exerted, the water would flow backwards unless the entrance were stopped in some way. This end is attained in the heart by the action of the semilunar valves.

Shortly after leaving the heart, the pulmonary artery divides into two branches which pass into the right and left lungs. At entering the lungs the branches subdivide again into numerous smaller branches, growing less and less until they form a network, over the air-cells, of hair-like tubes called capillaries.

The blood passes through the pulmonary artery and its branches, and in its passage over the air-cells absorbs oxygen from the air inhaled into the lungs, and gives out carbonic-acid gas which is exhaled in respiration. When the blood has absorbed the oxygen, it changes from a purple to a bright scarlet, and is then called *arterial* blood. The network of tubes or capillaries, after passing the air-cells, begin to combine, until finally they merge into the pulmonary *veins*, of which there are two leading from each lung. These convey the arterial blood back again to the *left* auricle, which by contraction forces it into the left ventricle, and from thence it is forced into the aorta, which is also furnished with valves similar to those described above in speaking of the right heart. The *aorta* divides into numerous branches, called *arteries*, which pass to all parts of the body, continuing to divide and subdivide until they terminate in fine, hair-like tubes or *capillaries*. The arterial blood here gives up the oxygen it has brought from the lungs, and absorbs carbonic acid and effete material from the surrounding tissues, changing its color in the process from scarlet to purple, when it is called venous blood. The capillaries again combine together by degrees until they merge into the larger tubes called veins, from which the blood is collected and conveyed back to the heart by the superior and inferior vena cava. The *superior vena cava* returns the blood to the heart from the head and upper extremities, and the *inferior vena cava* from the trunk and lower extremities. The venous and arterial circulation has thus completed its circuit.

There are many theories as to the action of the heart, which we have not space to discuss here. The most probable theory is, that the action is due to a nervous irritation caused by the passage of the blood through the heart.

The frequency of pulsation in a healthy heart varies with age, sex, and position of body. The following is a brief statement of the average number of pulsations in a minute: —

1st year....	115 to 130	per minute.
3d "	90 " 100	"
7th "	85 " 90	"
14th " . ..	80 " 85	"
Adult age ...	70 " 80	"
Old age	60 " 70	"

THE BLOOD (Fig. 10). — The importance of blood to the physical system is apparent to every one. It contains in itself all the elements necessary for the nourishment and reconstruction of the tissues of the body. It is the great channel of transportation in the body, not only of nutritive supplies to the tissues, but also of the consumed and worthless materials that have fulfilled their purpose, and are to be ejected from the body.

The blood is a thick, opaque fluid, of a rich red hue in the *arteries*, and a purplish-blue in the *veins*. It derives its color from numerous small bodies, called *red corpuscles*, floating in it.

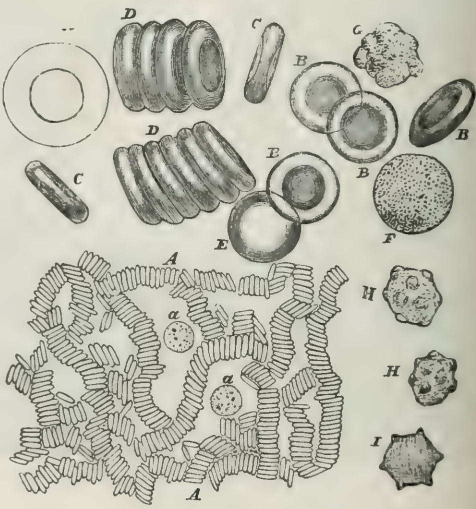


FIG. 10. — The Blood.

Red and White Corpuscles of the Blood magnified.

A, Moderately magnified. The red corpuscles are seen lying in rows like rolls of coins; at *a* and *a* are seen two white corpuscles. *B*, Red corpuscles much more highly magnified, seen in face; *C*, ditto, seen in profile; *D*, ditto, in rows, rather more highly magnified; *E*, a red corpuscle swollen into a sphere by imbibition of water; *F*, a white corpuscle magnified same as *B*; *G*, ditto, throwing out some blunt processes; *K*, ditto, treated with acetic acid, and showing nucleus, magnified same as *D*; *H*, red corpuscles puckered or crenate all over; *I*, ditto at the edge only.

The chemical composition of blood is as follows: —

Average proportions of constituents in 1,000 parts.

Water	784.	Red corpuscles	130.
Albumen	70.	Fibrine	2.02
Saline matters	6.03	Extractive, fatty and other matters,	7.77
			1,000.

If the blood be examined under a microscope, the red corpuscles will appear as thin circular disks floating in a transparent, nearly colorless fluid. There are also in the blood other floating particles, called white corpuscles: these are slightly larger than the red corpuscles, and are, in proportion to the latter, about one to three hundred in number. By a structural change, the white corpuscles ultimately become red corpuscles.

The red corpuscles are the animating and stimulating elements of the blood. They absorb oxygen in their passage through the lungs, and convey it to the tissues of the body, where, combining with other substances, it evolves animal heat.

In proportion to the muscular action of the body is the amount of the combustion of the tissues: thus, in violent exercise, the blood courses more rapidly through the vessels, the respirations become more frequent, and the heat of the body is increased. If the corpuscles in the blood become diminished from any cause (as in the disease called anæmia), the circulation and respirations become more rapid in order to compensate for their diminished number.

Albumen nourishes and supplies the soft tissues of the body.

Fibrine has merely a hæmastatic use in the blood; that is, of coagulating and stopping the passage of the blood, thus preventing too copious bleedings.

In conditions of the blood where this element is deficient, as in hæmorrhagic diathesis, commonly called "bleeders," great difficulty is experienced in stanching the effusion.

Saline Matters. — The principal salts in the blood are sodium chloride, or common salt, and phosphate of lime.

The former is found in all the fluids and tissues of the body, and the latter chiefly in the bony structures.

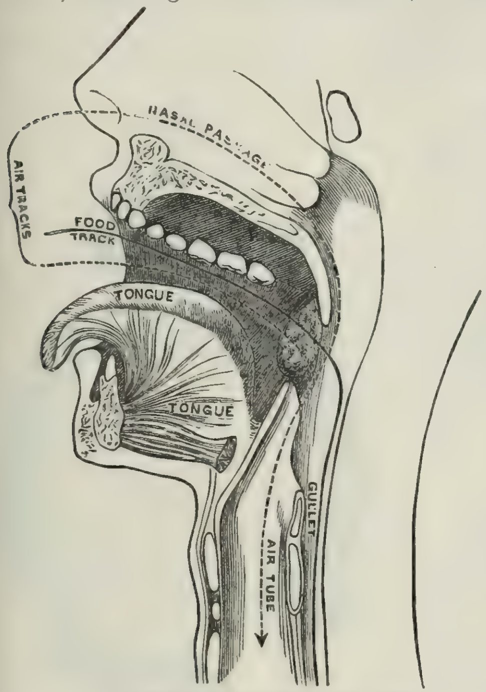


FIG. 11. — Diagram of Food and Air Tracks.

The solid line through mouth and gullet represents the course taken by food and drink; the dotted lines through mouth, nasal passages, and air-tube represent the course taken by the air.

It may be remarked also that iron is contained in the blood: it is from this element that the red corpuscles receive their color.

DIGESTION (Fig. 11). — The first act of digestion is that of mastication, or chewing. Food, on being introduced into the mouth, is subjected to a grinding or comminution by the teeth; the tongue moving it from side to side, and assisting in its mixture with the saliva.

Saliva is secreted or emitted from six glands, which are situated as follows: two, called the *parotid glands*, placed below the ear, just behind the jaw; two beneath the tongue, called the *sublingual;* and two under the lower jaw, named the *submaxillary* glands.

From these glands the saliva is conveyed to the mouth by small tubes, called ducts. There is a constant supply of saliva in the mouth, but it is only when any substance has been put into the mouth that a large flow takes place.

The amount of saliva secreted in the mouth during twenty-four hours is estimated at from two to three pints.

It is composed of: Water, 994.10; Solids, 5.90, — in every 1,000 parts.

The principal solids are salts of lime, soda, and potash, and also a very important constituent called *ptyaline.* The latter acts on the starchy matters of food, and converts them into what is called dextrine, or grape-sugar. It will be seen, therefore, how important it is to thoroughly masticate starchy substances.

As soon as the food has been sufficiently mixed with saliva, it becomes soft and pulpy; the tongue then collects and forms it into a round ball, and conveys it to the back part of the mouth, where it passes to the upper part of the throat, called the pharynx, and from thence, by a tube called the œsophagus, into the stomach. The œsophagus is about nine inches long, and is covered by muscles, which contract from above, thus forcing the food downward into the stomach.

The Stomach is a bag-shaped reservoir situated in the upper part of the abdomen. It is about twelve inches long and four inches wide, and holds in the average about five pints. It is composed of muscular fibre, and is lined with a honeycombed membrane called *mucous*, which also extends upwards through the œsophagus and pharynx into the mouth, and downwards into the intestines lining them.

As soon as the food passes into the stomach, a fluid called the *gastric juice* is thrown out by what are termed the gastric follicles.

The composition of gastric juice is as follows: —

Water	99.44	per cent.
Solids	.56	" "

The solids are, pepsin, hydrochloric acid, and salts of soda, lime, potash, and iron. The function of the hydrochloric acid, assisted by the pepsin, is to digest animal food and albuminous vegetable matter: on oils and starch it has no influence. The digestion of these latter will be described below, when speaking of the intestines.

As long as the stomach retains any food, it is in continual action, the contraction of its muscular fibres imparting a kind of churning motion to its contents. By this action the process of digestion is assisted, and the food is converted into the substance called *chyme.* While the stomach is in action, and the process of chymifi-

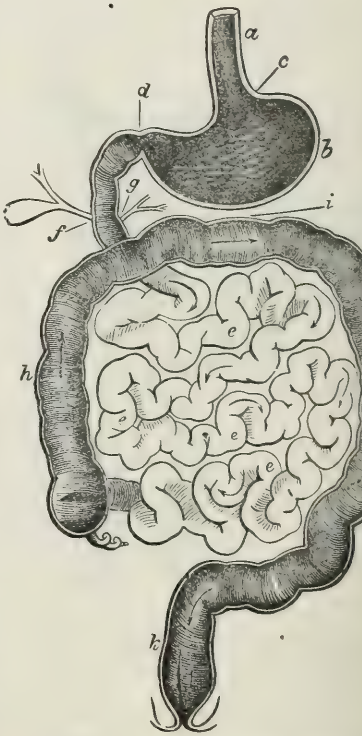


Fig. 12.— Human Alimentary Canal.

a, Œsophagus; *b*, Stomach; *c*, Cardiac orifice; *d*, Pylorus; *e*, Small intestine; *f*, Biliary duct; *g*, Pancreatic duct; *h*, Ascending colon; *i*, Transverse colon; *j*, Descending colon; *k*, Rectum.

cation is going on, those contents which have not been chymified are prevented from escaping into the intestines by a ring of muscular fibre called the pyloric valve.

The Intestinal Canal (Fig. 12), into which the chyme next passes, is a tube leading from the stomach, arranged in numerous folds or convolutions, and terminating in the anus. The intestines are composed of muscular fibre with a lining of mucous membrane, and are about five or six times the length of the body: the upper part (about twenty feet in length) is called the small intestine, and is covered all over with small projections or *villi*, whose function is to assist in the absorption of nutritive material; the lower part, or large intestine, is about six feet in length, and serves the purpose of retaining the excrements, or waste material, and conducting them from the body.

The chyme, in passing through the upper intestine, is acted on by alkaline secretions from the *pancreas* and *liver* (bile), which combine with the oily matters, converting them into soap, which, in its turn, is dissolved. The pancreatic fluid, which is similar in nature to saliva, also acts upon these starchy matters that have escaped the action of the saliva in mastication, and converts them into dextrine, or grape-sugar.

The next process of digestion is absorption. *Absorption* is performed by two sets of vessels, — first, the blood-vessels surrounding the stomach and intestines, which collect and convey albuminous, saccharine, and other constituents of the chyme to the liver. This is called the *portal* circulation, and will be described when speaking of the latter organ (see LIVER). Second, the lacteals, which are minute tubes running from the villi to the thoracic duct, and which absorb the saponaceous and other materials of the chyme, and convey them through the thoracic duct to a large vein situated under the left collar-bone, where they mingle with the blood. These materials, after entering the lacteals, are called *chyle*.

All the nutritive principles of food ultimately pass into the blood, which, in its course through the various tissues of the body, replaces with new material that which has become exhausted and useless. If the supply of nutrition does not equal the waste of material, then atrophy, or wasting of the tissues, ensues, and finally death.

Below is appended a schedule of the time required for the digestion of several articles of food: —

SUBSTANCE.	H. M.	SUBSTANCE.	H. M.	SUBSTANCE.	H. M.
Rice, boiled	1	Parsnips, boiled	2 30	Butter, melted	3 30
Eggs, whipped, raw	1 30	Potatoes, Irish, baked	2 30	Cheese, old, raw	3 30
Trout, fresh, fried	1 30	Cabbage, head, raw	2 30	Oyster, soup, boiled	3 30
Soup, barley, boiled	1 30	Custard, baked	2 45	Bread, wheat, fresh, baked	3 30
Apples, sweet, mellow, raw	1 30	Apples, sour, hard, raw	2 50	Turnips, flat, boiled	3 30
Venison steak, broiled	1 45	Oysters, fresh, raw	2 55	Potatoes, Irish, boiled	3 30
Sago, boiled	1 45	Eggs, fresh, soft-boiled	3	Eggs, fresh, hard-boiled	3 30
Tapioca, boiled	2	Beefsteak, broiled	3	Eggs, fresh, fried	3 30
Barley, boiled	2	Mutton, fresh, broiled	3	Green corn and beans, boiled	3 45
Milk, boiled	2	Mutton, fresh, boiled	3	Beets, boiled	3 45
Liver, beef, fresh, broiled	2	Soup, bean, boiled	3	Salmon, salted, boiled	4
Eggs, fresh, raw	2	Chicken, soup, boiled	3	Beef, fried	4
Apples, sour, mellow, raw	2	Dumpling, apple, boiled	3	Veal, fresh, broiled	4
Cabbage, with vinegar, raw	2	Oysters, fresh, roasted	3 15	Fowls, domestic, boiled	4
Milk, raw	2 15	Pork, salted, broiled	3 15	Beef, old, salted, boiled	4 15
Eggs, fresh, roasted	2 15	Porksteak, broiled	3 15	Pork, salted, fried	4 15
Turkey, domestic, roasted	2 30	Mutton, fresh, roasted	3 15	Pork, salted, boiled	4 30
Goose, wild, roasted	2 30	Bread, corn, baked	3 15	Veal, fresh, fried	4 30
Cake, sponge, baked	2 30	Carrot, orange, boiled	3 15	Cabbage, boiled	4 30
Hash, warmed	2 30	Sausage, fresh, broiled	3 20	Pork, roasted	5 15
Beans, pod, boiled	2 30	Oysters, fresh, stewed	3 30	Suet, beef, boiled	5 30

HUNGER.—The demand for food is purely a nervous sensation, which makes itself known through the agency of the stomach, as thirst does by the throat. The following is an explanation of this condition:—

The blood that is supplied to the nerves and tissues becomes deficient in those substances that nourish them. All the nerves acknowledge this want, but only those of the stomach transmit the sensation to the brain. Should this irritation continue for any length of time, the irritability of the nerves becomes impaired; and thus it is that, when nourishment is withheld for some time, the craving for food, which was present at first, afterwards passes off. So also, should the nerves of the stomach be deficient in tone, as seen in the loss of appetite, tonics are given to improve their condition. In fevers, and other acute affections where the appetite becomes impaired, it is not due to a loss of nervous power, but to the presence in the blood of effete or abnormal substances, which interrupt or disarrange the working of the whole nervous system.

THIRST.—The sensation indicating a want of fluid is referred to the throat, although, as in hunger, this is merely the local declaration of a general condition existing in the system. It differs, however, from hunger in this particular, that the longer fluids are abstained from, the greater is the desire for them. Thirst is due to irritation of certain nerves about the throat by the blood having become thicker than it should be, as water is constantly being eliminated by the skin, lungs, kidneys, etc. In fevers, the great and constant thirst experienced is due to the fact that the blood contains an excess of effete or solid matter, which demands a larger quantity of fluids to keep it in its proper dilution or specific gravity.

LIVER.—The liver is the largest organ in the abdomen. It is solid in structure, and of a reddish-brown color. It measures about twelve inches from side to side, and weighs from three to four pounds, and is divided into four lobes (Fig. 13). The situation of this organ is a little above the level of the stomach, and its lower margin extends along the line of the lower ribs, and reaches backward as far as the vertebræ or backbone.

If we examine the structure of the liver under the microscope, we find it is composed of a number of small round cells, closely packed together, called its *lobules.* These lobules are surrounded and pierced by a network of minute blood-vessels, which proceed from the portal vein. There are also numerous fine tubes traversing the substance of the liver, called the "biliary ducts." It is not definitely known whether these ducts proceed from the lobules, or merely run in the intervals between the lobules.

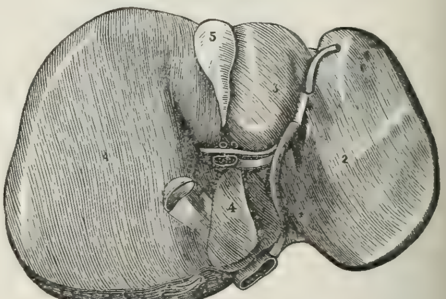


FIG. 13.—The Liver.

Under-surface of the Liver.—1, Right lobe; 2, Left lobe; 3, Quadrate lobe; 4, Spigelian lobe; 5, Gall-bladder.

If we turn to the under-surface of the liver, we notice four tubes which enter into and leave that organ. The largest of these four is called the *portal* vein: this vein springs from the capillaries, or small blood-vessels that surround the stomach and intestines, and also from the substance of the spleen. It conveys the blood, which is charged with material absorbed from the stomach and intestines during the process of digestion, to the liver, there to undergo certain chemical changes, which will be described below. Another of these tubes is the *hepatic artery*, which enters the liver, dividing and subdividing into numerous branches, supplying the tissues of the liver with nourishment. The third tube is the *hepatic vein*, which collects the blood that has been brought to the liver by the portal vein and hepatic artery, and conveys it to a large vein that leads to the heart. The fourth is the *hepatic duct*, which conducts the bile from the biliary ducts to the intestines, while digestion is going on; otherwise, to the gall-bladder, which is a pear-shaped bag placed at the under-surface of the liver.

Functions of the Liver.—I. To eliminate effete material circulating in the blood, and to convert it into bile.

II. To convert albuminous substances into a saccharine material known as glycogen, or "liver-sugar."

I. As has been stated above, the portal vein conducts the blood from the vicinity of the stomach and intestines to the liver; there it passes through the minute blood-vessels that pierce the lobules, and the effete and useless materials contained in the blood are abstracted from it, and converted into bile. Bile is a somewhat viscid fluid, of a golden-brown color, approaching an orange hue, and is of a strongly bitter taste. Its uses are,—

1. To assist in emulcifying fatty matters.

2. To act as an antiseptic in preventing putrefaction of substances contained in the intestines; and,—

3. To act as a natural purgative of the bowels. Should anything interfere to check the free passage of the bile through the hepatic duct, it is reabsorbed by the blood and is carried to the various issues of the body, tingeing them with a yellowish hue, as we see in jaundice.

II. The conversion of albuminous matters into glycogen, or liver-sugar, is a chemical change produced by the abstraction of certain constituents in their passage through the liver. This glycogen is then carried with the blood to the lungs, where it unites with oxygen, and chemical combustion ensues, which assists in the production of animal heat.

The liver is one of the most delicately adjusted organs of the body, and the disturbance of its healthy condition is the source of many disorders of the system, such as headache, dyspepsia, internal piles, abdominal dropsy, etc.

KIDNEYS (Fig. 14).—These are two glands having for their office the secretion of urine. That this office or function is of the greatest importance is sufficiently shown by the fact, that if, in consequence of disease, the secretion of urine becomes altogether suspended for a day or two, death not unfrequently occurs. The human kidneys are situated in the region of the loins, on each side of the spine, and are imbedded in a layer of fatty tissue. Their form is too well known to require description; their average weight is from four to six ounces. On making a vertical section of the kidneys, they are seen to consist of two different substances, which are named, from their position, the external or *cortical* and the internal or *medullary* substances. With the exception of blood-vessels, lymphatics, etc., the substance of the kidneys may be said to be composed of small tubes, called the *tubuli uriniferi.* These tubes run from the cavity of the kidneys to their circumference, and give to the medullary portion a striated appearance. The *cortical portion* of the kidneys has a granular appearance, which is due to the formation of small round bodies in this substance. These round bodies or cells are nothing more than the dilated extremity of the urinary tube, which has passed into the

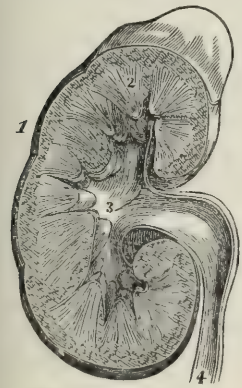


FIG. 14.—The Kidneys.

The Kidney, cut open longitudinally.—1, Granular portion; 2, Striated portion; 3, Central cavity, or pelvis, of the kidney; 4, Ureter.

cortical portion of the kidney. The centre of the kidney is hollow; and continuous with this cavity is a tube, known as the *ureter*, which conveys the urine from the kidney to the bladder.

SECRETION OF URINE. — The separation from the blood of the solids, in a state of solution, is probably effected, like other secretions, by the agency of gland-cells, which the tubes are lined with. The watery part of the urine is separated by the same structures that secrete the solids. The quantity of blood passing through the kidneys is large; but, should anything (such as congestion, by which the blood-vessels are diminished in size) interfere with this free passage, the amount of urine secreted is diminished, giving rise to headaches, vomiting, and purging, this being due to the presence, in the blood, of urea and other substances which should have been secreted. In some cases, such as severe congestion or inflammation of the kidneys, the small capillaries rupture, or the blood exudes through them, which gives rise to blood in the urine.

In that chronic affection known as Bright's disease of the kidneys, the walls of the blood-vessels become diseased, and, besides the passage of solids and water normally contained in the urine, the albumen of the blood also passes out. This results in reducing the specific gravity of the blood, so that the blood-vessels situated in other portions of the body allow the fluids to escape, and this is shown by dropsies that invariably follow diseased kidneys.

SPLEEN. — This is a small organ of a brownish-red color, situated in the upper and left side of the abdominal cavity. In structure it is spongy and vascular, the blood-vessels distributed to it being of a large size. Under the microscope, small, round cells are noticed distributed throughout the whole organ, which are called malpighian corpuscles.

Functions of the Spleen. — Little or nothing is known as to the functions or uses of the spleen. It is, however, supposed to have some influence on the blood passing through it; and it also acts as a diverticulum or reservoir for the excess of blood formed during digestion.

In some diseases, such as malarial fevers, it increases in size; sometimes weighing as much as eighteen or twenty pounds. In animals, and even in man, it has been removed without any ill effects following.

MUSCLES. — There are about four hundred and fifty-four muscles in the human system that assist in the movements of the body. Muscles are divided into two classes, according to their appearance under the microscope. The first class are the *striped* or *voluntary* muscles. The second class are named the *unstriped*, or the involuntary, on account of their being placed and supplied by nerves which the will has no direct power over. The unstriped muscles are found in the intestines, stomach, heart, etc.

The muscles are connected with bones, cartilages, ligaments, and skin, either directly or through the intervention of fibrous structures, called tendons or aponeuroses. Where a muscle is attached to bone or cartilage, the fibres terminate in blunt extremities upon the periosteum or perichondrium (a thin membrane which covers bone and cartilage), and do not come into direct relation with the bony and cartilaginous tissue. Where muscles are connected with the skin, they either lie as flattened layers beneath it, or are connected with fascia immediately below it.

In the description of a muscle, the term *origin* is meant to imply its more fixed or central attachment; and the term *insertion*, the movable point to which the force of the muscle is directed.

Tendons are white, glistening, fibrous cords, varying in length and thickness, sometimes round, sometimes flattened, and of considerable strength.

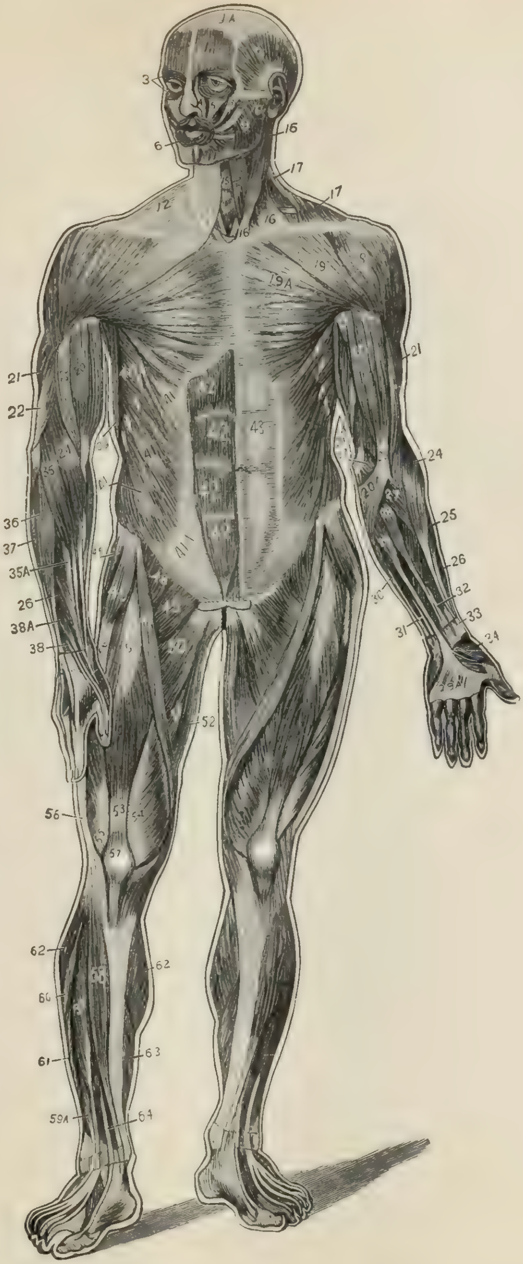


Fig. 15.—The Muscular System (Front View).

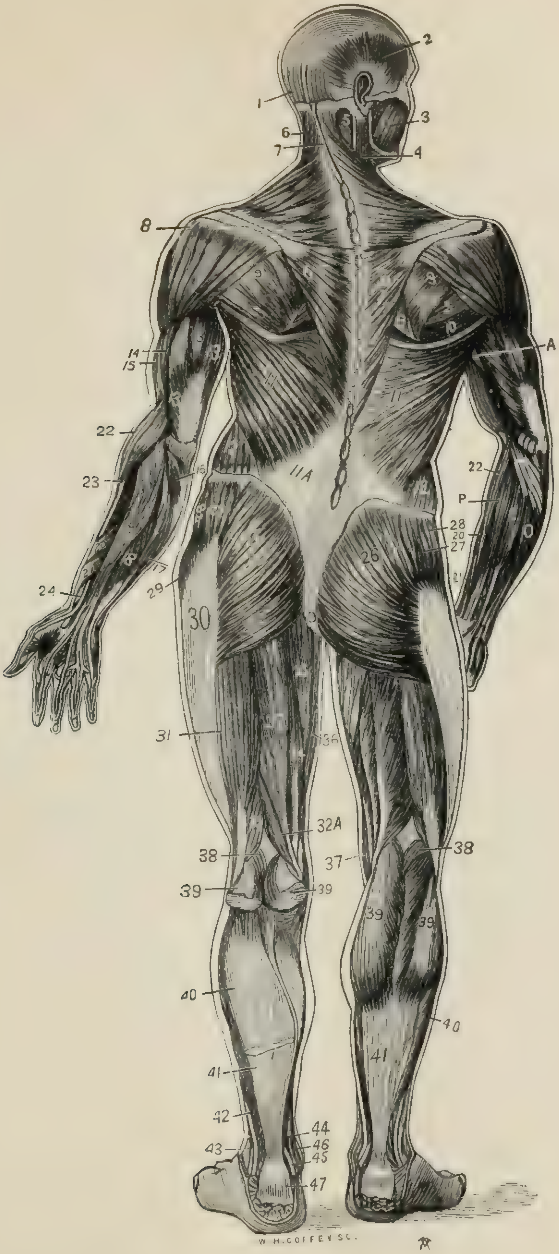


FIG. 16. — The Muscular System (Back View).

Aponeuroses are fibrous membranes, of a pearly-white color, and similar in structure to the tendons.

The following is a description of the muscles shown in Figs. 15 and 16. Those who desire a fuller account of the muscular system should consult the anatomical works of Gray or Wilson.

Fig. 15. — Front View.

(1.) *Occipito-frontalis.* — The frontal portion is shown, its fibres are continuous with the *pyramidulis nasi* and blended with the *orbicularis.* Actions: The frontal portion of this muscle raises the eyebrows and skin over the root of the nose; at the same time throwing the integument of the forehead into transverse wrinkles, as seen in the emotions of delight and surprise.

(1 a.) *Tendinous Aponeurosis* of above muscle, covering the vertex of the skull.

(2.) *Temporal,* arising from the *temporal,* parietal, frontal, and sphenoid bones. Its fibres converge as they descend, and are inserted into the *anterior* border of the *lower jaw.* Action: Raises the lower jaw against the upper jaw with great force.

(3.) *Orbicularis Palpebrarum* arises from the bones situated at the inner angle of the orbit, and surrounds the circumference of the orbit and eyelids. Action: Closes the eye. When acting strongly, the integuments of the forehead, temple, and cheek are drawn inwards towards the inner angle of the eye.

(4.) *Levator Labii Superioris Alæque Nasi* arises from the *superior* maxillary bone, near the inner angle of the orbit, and is inserted by two narrow slips, one into the cartilage at the side of the nose; the other is prolonged into the upper lip. Actions: Its most important action is on the nose, which it dilates to a considerable extent, at the same time lifting the upper lip. It is the principal agent in the expression of contempt.

(5.) *Levator Labii Superioris* is a thin muscle arising from the lower margin of the orbit, some of its fibres being attached to the superior maxilla, others to the malar bone; its fibres converge to be inserted in the upper lip. Action: It elevates the upper lip. at the same time carrying it a little outwards, as in laughing.

(6.) *Orbicularis Oris* is a sphincter muscle which surrounds the orifice of the mouth. Action: It contracts the lips.

(7.) *Zygomaticus Major* is a slender muscle which arises from the malar bone, and is inserted into the angle of the mouth.

(8.) *Zygomaticus Minor* also arises from the malar bone (more internally), and is inserted into the outer margin of the *Levator Labii Superioris.* Both these muscles have the same action as the *Levator Labii Superioris.*

(9.) *Masseter, superficial portion,* which arises from the superior maxillar and zygomatic arch, and inserted into the angle and lower half of the ramus of the lower jaw.

(10.) Is the deep portion of the same muscle which arises from posterior third of the lower border and whole of the inner surface of the zygomatic arch, and is inserted into the upper half of the ramus of the lower jaw. Action is similar to that of the *temporal* muscle.

(11.) *Depressors of the lower lip;* viz., Depressor Labii Inferioris, Depressor Anguli Oris. These two muscles depress the lower lip. They are attached to the lower jaw, and inserted into the muscular structure of the lip.

(12.) *Platysma Myoides* is a broad, thin plane of muscular fibres, placed immediately beneath the skin on each side of the neck. It arises from the clavicle, acromion process of the scapula, and the fascia about the shoulder, and is inserted into the lower jaw. Action is to assist the other depressor muscles of the lower jaw.

(13.) *Omo-hyoid* passes across the neck from the scapula to the hyoid bone. It consists of two fleshy bellies, united by a central tendon; the tendon passes through a loop of fascia, which is made fast to the cartilage of the first rib. Action: It depresses the hyoid bone; it also carries it backwards.

(14.) *Sterno-hyoid* is a thin, narrow, ribbon-like muscle, which arises from the inner extremity of the clavicle and upper and posterior part of the first piece of the sternum, and, passing upwards and inwards, is inserted into the hyoid bone. Action is to depress the hyoid bone and larynx.

(15.) *Thyroid Cartilage.*

(16, 16, 16.) *Sterno-cleido-mastoid,* as its name indicates, arises from the sternum and clavicle, and is inserted into the mastoid process of the temporal, and occipital bones. Action: When both muscles are brought into action, they serve to depress the head upon the neck, and the neck upon the chest. Either muscle, acting singly, flexes the head (combined with the splenius), draws it towards the shoulder of the same side, and rotates it so as to carry the face towards the opposite side.

(17, 17.) *Trapezius* is shown attached to the clavicle and acromion process of the scapula.

(18.) *Deltoid* is a large, thick, triangular muscle, which forms the convexity of the shoulder. It arises from the clavicle, acromion process and spine of the scapula, and is inserted into a rough prominence on the middle and centre side of the shaft of the humerus. Action: Its principal action is to raise the arm directly from the side, so as to bring it at right angles with the trunk.

(19.) *Pectoralis Major* arises from the sternum, and the cartilages of the first seven ribs, with the exception frequently of the first, or of the seventh, or both. The fibres converge, and are inserted into the shaft of the humerus, immediately below its head. Action: It draws the arm across the chest (19 A); shows the sternal origin of above muscle.

(20, 20.) *Biceps* arises by two heads, one from the coracoid process, and the other from the upper margin of the glenoid cavity of the scapula. This muscle is of a large size about its centre, but becomes contracted into a strong tendon, which is inserted in a tuberosity situated on the upper part of the radius. Action: Is the powerful flexor of the forearm. The contraction of this muscle increases the size and convexity of the arm.

(20 A.) *Bicipital Fascia* is a broad aponeurosis given off from the tendon of the biceps, opposite the bend of the ulna.

(21, 21, 21.) *Triceps,* situated on the back of the arm. It arises by three heads, — one from the scapula, below the glenoid cavity, and the other two from each side of the shaft of the humerus. It is inserted into the upper and back part of the ulna, known as the olecranon process. Action: It extends the forearm after being flexed.

(22.) *Brachialis anticus* arises from the shaft of the humerus, and is inserted into the coronoid process of the ulna. Action: It assists the *Biceps* in flexing the forearm.

(23.) *Coraco-brachialis* arises by fleshy fibres from the apex of the coracoid process of the scapula, and is inserted into a rough ridge at the middle of the inner side of the shaft of the humerus. Action is to draw the humerus forwards and inwards, and at the same time assist in elevating it towards the scapula.

(24.) *Supinator Longus* is situated on the outer side of the forearm. It arises from a ridge on the outer and lower part of the *humerus*, and is inserted into the end of the *radius*. Action: It supinates the hand and forearm.

(25.) *Extensor Carpi Radialis Longior* arises immediately below the above muscle, and is inserted into the base of the metacarpal bone of the index finger, on its radial side. Action: It extends the wrist.

(26.) *Extensor Ossis Metacarpi Pollicis* arises from the posterior surface of the shaft of the ulna and radius, and, passing on the outer side of the radius, is inserted into the base of the metacarpal bone of the thumb. Action is the same as the above muscle.

(27.) *Pronator Radii Teres* arises by two heads, one from the *humerus*, and the other from the upper part of the *ulna*. It passes obliquely across the forearm, and is inserted into a rough ridge at the middle and outer surface of the shaft of the *radius*. Action: It pronates the hand and forearm.

(28.) *Flexor Carpi Radialis* lies on the inner side of the preceding muscle. It arises from the inner condyle of the humerus, and is inserted into the base of the metacarpal bone of the index finger. Action is to assist in the flexion of the wrist.

(29.) *Palmaris Longus* is a slender muscle, lying on the inner side of the preceding. It arises from the inner condyle of the humerus, and is inserted by a flattened tendon into the annular ligament, expanding to end in the palmar fascia. Action: It is a tensor of the palmar fascia; when this action has been fully effected, it flexes the hand upon the forearm.

(29 A.) *Palmar Fascia.*

(30.) *Flexor Carpi Ulnaris* lies along the ulnar side of the forearm. It arises by two heads, — one from the inner condyle of the humerus, and the other from the inner margin of the oberanon process of the ulna. The fibres terminate in a tendon, which is inserted into the pisiform bone, one of the carpal. Action: It is flexor of the wrist.

(31.) *Flexor Sublimis Digitorum* arises from the inner condyle of the humerus, inner side of the coronoid process of the ulna, and from the shaft of the radius. The fibres pass vertically downwards, forming a broad and thick muscle, which divides into four tendons about the middle of the forearm. The tendons pass beneath the annular ligament, and are inserted into the second phalanges of the four fingers about their middle. Action is to flex the fingers.

(32.) *Flexor Longus Pollicis* arises from the upper two thirds of the anterior surface of the shaft of the radius, and is inserted by a long tendon into the last phalanx of the thumb. Action is to flex the last phalanx of the thumb.

(33.) *Annular Ligament* is a band of strong, white, fibrous tissue, which extends across the wrist, bending the muscular tendons down and keeping them in position.

(34.) *Abductor Pollicis* is a thin, flat muscle, placed immediately beneath the skin, on the outer side of the hand. It arises from os trapezium, one of the carpal bones, and is inserted in the outer side of the base of the first phalanx of the thumb. Action is to abduct the thumb from the palm.

(35.) *Extensor Carpi Radialis Longior* arises from the external ridge on the lower part of the humerus, and is inserted into the base of the metacarpal bone of the index finger. Action: Extensor of the wrist.

(35 A.) *Extensor Carpi Radialis Brevior* arises from the external condyle of the humerus, and is inserted into the base of the metacarpal bone of the middle finger. Action same as the above.

(36.) *Extensor Communis Digitorum* is situated at the back of the forearm. It arises from the external condyle of the humerus, and is inserted by four tendons into the second and third phalanges of the fingers. (See Back View.) Action is to extend the fingers.

(37.) *Extensor Carpi Ulnaris* arises from the external condyle of the humerus, and is inserted by a narrow tendon into the base of the metacarpal bone of the little finger. Action: Assists in extending the wrist.

(38 A.) *Extensor Primi Internodii Pollicis* arises from the posterior surface of the shaft of the radius, and is inserted into the base of the first phalanx of the thumb.

(38.) *Extensor Secundi Internodii Pollicis* arises from the posterior surface of the shaft of the ulna, and is inserted into the last phalanx of the thumb. Action of these two muscles is to extend the thumb.

(39.) *Latissimus Dorsi:* its insertion into the humerus is shown in this figure. (See 11, Back View.)

(40.) *Serratus Magnus* arises by nine fleshy digitations from the outer surface of the eight upper ribs, and is inserted into the whole of the inner and posterior border of the scapula. Actions: The *serratus magnus* is the most important external inspiratory muscle. When the shoulders are fixed, it elevates the ribs, and so dilates the cavity of the chest. This muscle, especially its middle and lower segments, draws the base and inferior angle of the scapula forwards, and so raises the point of the shoulder by causing a rotation of the bone on the side of the chest, assisting the *trapezius* muscle in supporting weights upon the shoulder.

(41, 41, 41.) *Obliquus Externus* is a broad, thin muscle, which takes part in the formation of the abdominal walls. It arises by eight fleshy digitations from the external surface of the eight inferior ribs. Its fibres run in various directions. The upper and middle fibres run in an oblique direction, and join the opposite muscle along the medium line, covering the whole of the front of the abdomen. The lower fibres pass downwards to be inserted into the crest of the ilium from this point; the fibres become folded inward and extend across to the pubes, forming what is known as Poupart's ligament.

(41 A.) *Abdominal Fascia.*

(42, 42, 42.) *Rectus Abdominis* is a long, flat muscle, which extends along the whole length of the front of the abdomen. It arises from the pubes, and is inserted into the cartilages of the fifth, sixth, and seventh ribs. Only one muscle (left side) is shown; the other is covered by its sheath.

(43.) *External Sheath of the Rectus*, which is formed by an extension or aponeurosis of the oblique and transversalis muscles.

(44.) *Pyramidalis* is a small muscle, triangular in shape, placed at the lower part of the abdomen in front of the rectus, and contained in the same sheath with that muscle. It arises from the os pubes, and is inserted into the linea alba, or sheath of the rectus, midway between the umbilicus and os pubes.

(45.) *Gluteus Medius*, the anterior or front portion of this muscle is shown. (See Back View, 27.)

(46.) *Tensor Vaginæ Femoris* is a short, flat muscle, situated at the upper and outer side of the thigh. It arises from the outer lip of the crest of the ilium, and is inserted into the fascia lata about one fifth down the outer side of the thigh. Action: It is a tensor of the fascia lata, and also assists in the rotation of the thigh inwards.

(47.) *Sartorius*, the longest muscle in the body, is flat, narrow, and ribbon-like. It arises from the anterior border of the ilium, and descends vertically to the inner surface of the shaft of the tibia, near its upper part, where it is inserted. Action: Flexes the leg upon the thigh, and, continuing to act, flexes the thigh upon the pelvis, at the same time drawing the limb inwards so as to cross one leg over the other.

(48.) *Psoas Magnus* arises from sides of the bodies, intervertebral substances, and front of the transverse processes of the six lower vertebræ; is inserted into the lesser trochanter of the femur. Only a portion of this muscle can be seen in the figure. Action is to flex the thigh upon the pelvis, at the same time rotates the thigh outwards. It also serves to maintain the erect position by supporting the spine and pelvis upon the femur, and assists in raising the trunk when the body is in the recumbent posture.

(49.) *Pectineus* arises from the os pubes, and is inserted into the upper and back part of the femur. Actions same as the two following muscles.

(50.) *Adductor Longus* arises by a narrow, flat tendon, from the front of the pubes, and soon expands into a broad, fleshy belly, which passes downwards and outwards, to be inserted by an aponeurosis into the middle and back part of the shaft of the femur.

(51) *Adductor Magnus* is a large triangular muscle, forming a septum or division between the muscles on the inner and those on the back of the thigh. It arises from the pubes and ischium, and is inserted into a ridge on the back or posterior surface of the femur, which ridge extends from the neck of the femur to the inner condyle. Actions: The pectineus and adductors adduct the thigh powerfully; they are especially used in horse exercise, the flanks of the horse being grasped between the knees by the action of these muscles. In consequence of the obliquity of their insertion, they rotate the thigh outwards, assisting the external rotators; and when the limb has been adducted, they draw it inwards, carrying the thigh across that of the opposite side. They also assist in flexing the thigh upon the pelvis.

(52.) *Gracilis* arises from the ramus of the pubes and ischium. The fibres pass vertically downwards and terminate in a rounded tendon, which passes behind the inner condyle of the femur, and, curving round the inner tuberosity of the tibia, becomes flattened and is inserted into the upper part of the inner surface of the shaft of the tibia. Action is to assist the sartorius in flexing the leg and drawing it inwards. It is also an adductor of the thigh.

(53.) *Rectus Femoris* arises by two heads from the ilium. The muscle terminates in a broad and thick aponeurosis, which occupies the lower two thirds, and, gradually becoming narrowed into a flattened tendon, is inserted into the patella or knee-pan.

(54.) *Vastus Internus* arises from the posterior inner and anterior surfaces of the shaft of the femur, and is inserted into the patella.

(55.) *Vastus Externus* arises from the posterior surface of the shaft of the femur, and is inserted into the patella. Actions: The rectus and vasti have the same action, which is to extend the leg upon the thigh. Taking its fixed point from the leg, as in standing, these muscles will act upon the femur, supporting it perpendicularly upon the head of the tibia, and thus maintaining the entire weight of the body.

(56.) *Fascia Lata* is the deep fascia of the thigh, which, on the outer side of the thigh, becomes thickened from the addition of the muscle attached to it.

(57.) *Patella*, covered by the tendons of the vasti and rectus muscles. (See Fig. 21, No. 30.)

(58.) *Tibialis Anticus* arises from the outer tuberosity and upper two thirds of the external surface of the shaft of the tibia; the muscle terminates in a tendon, which is inserted into the inner and under surface of the internal cuneiform bone, and base of the metatarsal bone of the great toe. Action: to flex the ankle; it also raises the inner border of the foot.

(59.) *Extensor Longus Digitorum* arises from the outer tuberosity of the tibia, and outer three fourths of the anterior surface of the shaft of the fibula. The muscle terminates in three tendons, which pass through a canal in the annular ligament, and are inserted into the second and third phalanges of the four lesser toes, the innermost tendon being subdivided into two. Action is to extend the phalanges of the toes.

(59 A.) *Peroneus Tertius* arises from the lower fourth of the anterior surface of the fibula, on its outer side, and is inserted into base of the metatarsal bone of the little toe on its inner side. Action is to assist in the flexion of the ankle.

(60.) *Peroneus Longus* arises from the upper two thirds of the outer surface of the shaft of the fibula. The muscle terminates in a long tendon, which passes along the outer side of the ankle across the sole of the foot, to be inserted into base of the metatarsal bone of the great toe. Action is to extend the foot upon the leg: it also turns the sole of the foot outwards.

(61.) *Peroneus Brevis* arises from the middle third of the external surface of the shaft of the fibula. The fibres terminate in a tendon, which runs in front of that of the preceding muscle, to be inserted into the base of metatarsal bone of the little toe. Action is to assist in the extension of the foot.

(62.) *Gastrocnemius.* — Front View. (See Back View, 39.)

(63.) *Soleus.* (See Back View, 40.)

(64.) *Extensor Propius Pollicis* arises from the anterior surface of the fibula for about the middle two fourths of its extent. The fibres terminate in a tendon, which is inserted into the base of the last phalanx of the great toe. Action is to extend the great toe.

FIG. 16. — Back View.

(1.) *Occipito-frontalis* is shown arising from the temporal and occipital bones. (See Front View, 1.)

(2.) *Temporal.* (See Front View, 2.)

(3.) *Masseter.* (See Front View, 9.)

(4.) *Sterno-cleido Mastoid.* (See Front View, 16, 16, 16.)

(5.) *Splenius Capitis and Colli.* — The *splenius* is situated at the back of the neck and upper part of the dorsal region. At its origin it is a single muscle, narrow and pointed in form; but it soon becomes broader, and divides into two portions, which have separate insertions. It arises, by tendinous fibres, from the lower half of the ligamentum nuchæ (7), and from the spinous process of the last cervical and of the upper dorsal vertebræ. From this origin the fibres proceed obliquely upwards and outwards, and divide into two portions, — the *splenius capitis*, which is inserted into the occipital and temporal bones; and the *splenius colli*, into the three or four upper *cervical vertebræ.* Actions: The splenii muscles of the two sides, acting together, draw the head directly backwards; while, acting separately, they assist (6 and 4) in drawing it to one or the other side, and slightly rotate it.

(6.) *Trapezius* arises from the occipital bone, ligamentum nuchæ, and the spinous process of the seventh cervical and those of all the dorsal vertebræ. From this extensive origin the fibres pass outwards to be inserted into the clavicle, acromion process and spine of the scapula, as seen in Front View, 17, 17. Action is to draw the head backwards, or from side to side. It also assists in supporting the head in the erect position.

(7.) *Ligamentum Nuchæ* is a broad band of condensed cellulo-fibrous membrane, placed in the line of union between the two trapezii in the neck. It extends from the occipital bone to the spinous process of the seventh cervical vertebræ. In man it is merely the rudiment of an important elastic ligament, which, in some of the lower animals, serves to sustain the weight of the head.

(8.) *Deltoid.* (See Front View, 18.)

(9.) *Supraspinatus* arises from the upper and back part of the scapula, from the part known as the supraspinous fossa, and is inserted into the upper part of the humerus.

(S.) *Infraspinatus* arises from the infraspinous fossa of the scapula, and is inserted into the humerus immediately below the preceding muscle. Actions: The *supraspinatus* assists the deltoid in raising the arm from the side, and fixes the head of the humerus in its socket. *Infraspinatus* assists in rotating the head of the humerus outwards. When the arm is raised, they assist in retaining it in that position and carrying it backwards.

(B.) *Rhomboideus Major* arises from the spinous processes of the four or five upper dorsal vertebræ, and is inserted into the inner border of the scapula. Action is to assist in drawing the scapula backwards and upwards.

(10.) *Teres Major* arises from the back and inferior angle of the scapula, and is inserted by a flat tendon into the upper part of the humerus. Action is to assist the *Latissimus Dorsi* in drawing the humerus downwards and backwards when previously raised, and rotating it inwards when the arm is fixed.

(11.) *Latissimus Dorsi* is a broad, flat muscle which covers the lumbar and lower half of the dorsal regions. It arises by an aponeurosis from the spinous processes of the six inferior dorsal from those of the lumbar and sacral vertebræ. It also arises from the external lip of the crest of the ilium, and by fleshy digitations from the three or four lower ribs. From this extensive origin the fibres pass upwards to be inserted into the shaft of the humerus. (See Front View, 30.) Action: When it acts upon the humerus, draws it backwards and downwards, at the same time rotates it inwards. It also assists in forcible inspiration; and, when the arms are fixed, the two muscles may assist the abdominal and great pectoral muscles in drawing the whole trunk forwards, as in climbing, or walking on crutches.

(11 A.) *Lumbar Aponeurosis* given off by the *Latissimus Dorsi.*

(12.) *Obliquus Externus.* (See Front View, 41, 41, 41.)

(E.) *Bicipital Fascia.* (See Front View, 20 A.)

(13.) *Triceps.* (See Front View, 21, 21, 21.)

(14.) *Brachialis Anticus.* (See Front View, 22.)

(15.) *External Head of the Biceps.* (See Front View, 20.)

(16.) *Anconeus* is a small triangular muscle, placed behind and below the elbow joint, and appears to be a continuation of the external portion of the triceps. It arises from the outer condyle of the humerus, and is inserted into the side of the olecranon and upper fourth of the posterior surface of the shaft of the ulna. Action is to assist the triceps in extending the forearm.

(17.) *Extensor Carpi Ulnaris.* (See Front View, 37.)

(18.) *Extensor Minimi Digiti* is a slender muscle placed on the inner side of the *Extensor Communis*, with which it is generally connected. It arises from the external condyle of the humerus, and is inserted into the second and third phalanges of the little finger. Action is to extend the little finger.

(19.) *Extensor Communis Digitorum.* (See Front View, 36.)

(20.) *Extensor Ossis Metacarpi Pollicis.* (See Front View, 26.)

(21.) *Extensor Primi Internodii Pollicis.* (See Front View, 38 A.)

(22.) *Supinator Longus.* (See Front View, 24.)

(23.) *Extensor Carpi Radialis Longior.* (See Front View, 25.)

(24.) *Extensor Secundi Internodii Pollicis.* (See Front View, 38.)

(C.) *Palmaris Longus.* (See Front View, 29.)

(O.) *Flexor Carpi Ulnaris.* (See Front View, 30.)

(P.) *Flexor Carpi Radialis.* (See Front View, 28.)

(26.) *Gluteus Maximus* is the most superficial muscle in the gluteal region. It is a very broad and thick, fleshy mass, which forms the prominence of the nates. Its large size is one of the most characteristic points in the muscular system in man, connected as it is with the power he has of maintaining the trunk in the erect posture. It arises from the outer and back part of the ilium, posterior surface of the last piece of the sacrum, the side of the coccyx and the sacrosciatic, and sacro-iliac ligaments; and is inserted into fascia lata (30), covering the outer side of the thigh. Action is to extend the femur, and make tense the fascia lata. It also rotates the thigh outwards.

(27.) *Gluteus Medius* arises from the outer surface of the ilium, being more anterior than the preceding muscle. (See Front View, 45.) The fibres converge to a strong, flattened tendon, which is inserted into the oblique line which traverses the outer surface of the great trochanter of the femur.

(28.) *Gluteus Minimus*, the smallest of the three glutei, is placed immediately beneath the preceding. It arises from the outer surface of the ilium, and is inserted into the anterior border of the great trochanter of the femur. Actions: The *Gluteus Maximus* and *Minimus* rotate the thigh inwards, etc. Taking their fixed point from the femur, the glutei muscles act upon the pelvis, supporting it and the whole trunk upon the head of the femur, which is especially obvious in standing on one leg.

(29.) *Tensor Vaginæ Femoris.* (See Front View, 46.)

(30.) *Fascia Lata.* (See Front View, 56.)

(31.) *Biceps* is a large muscle, of considerable length, situated on the posterior and outer aspect of the thigh. It arises by two heads. One, the long head, arises from the back part of the tuberosity of the ischium. The femoral or short head arises from the back part of the shaft of the femur, and is inserted into the outer side of the head of the fibula. (Actions, see below.)

(32.) *Semitendinosis*, remarkable for the great length of its tendon, is situated at the posterior and inner aspect of the thigh. It arises from the tuberosity of the ischium by a tendon common to it, and the long heads of the biceps. It also arises by a short head from an aponeurosis, which connects the adjacent surfaces of the two muscles to the extent of about three inches after their origin, and is inserted into the inner and upper part of the shaft of the tibia. (Actions, see below.)

(32 A.) *Semitendinosis*, its short head.

(33.) *Adductor Magnus.* (See Front View, 51.)

(34.) *Semimembranosus*, so called from membranous expansion on its anterior and posterior surfaces. It is situated at the back and inner side of the thigh. It arises by a thick tendon from the back part of the tuberosity of the ischium, and is inserted into the inner and back part of the inner tuberosity of the tibia. Actions: The biceps forms the outer hamstring; the inner one being formed by the semitendinosis, semimembranosis, gracilis, and sartorius.

The hamstring muscles flex the leg upon the thigh. When the knee is semiflexed, the biceps, in consequence of its oblique direction downwards and outwards, rotates the leg slightly outwards; and the semimembranosus, in consequence of its oblique direction, rotates the leg inwards, assisting the Popliteus. Taking their fixed point from below, these muscles serve to support the pelvis upon the head of the femur, and to draw the trunk directly backwards, as in feats of strength, when the body is thrown backwards in the form of an arch.

(35.) The short head of the *biceps*.

(36.) *Gracilis.* (See Front View, 52.)

(37.) *Sartorius.* (See Front View, 47.)

(38.) *Plantaris* is an extremely diminutive muscle placed between the gastrocnemius and soleus, and remarkable for its long and delicate tendon. It arises from the lower and outer side of the femur; its tendon crosses obliquely between the two muscles of the calf, and, running along the inner border of the tendo-achillis, is inserted into the posterior part of the os calcis.

(39.) *Gastrocnemius* is the most superficial muscle, and forms the greater part of the calf. It arises by two heads, which are connected to the condyle of the femur by two strong, flat tendons. The fibres converge into a strong tendon (tendo-achillis), which is attached to the os calcis, the bone of the heel. (Actions, see below.)

(40.) *Soleus.* — The soleus is a broad, flat muscle situated immediately beneath the preceding. It arises from the tibia and fibula, and joins with the tendon of the gastrocnemius to form the tendo-achillis, which is inserted into the os calcis. Actions: The muscles of the calf possess considerable power, and are constantly called into use in standing, walking, dancing, leaping; hence the large size they usually present. In walking, these muscles draw powerfully upon the os calcis, raising the heel, and with it the entire body, from the ground: the body being thus supported on the raised foot, the opposite limb can be carried forward. In standing, the soleus, taking its fixed point from below, steadies the leg upon the foot, and prevents the body from falling forward. The gastrocnemius, acting from below, serves to flex the femur upon the tibia.

(41.) *Tendo-Achillis*, the thickest and strongest tendon in the body.

(42.) *Peroneus Longus.* (See Front View, 60.)

(43.) *Peroneus Brevis.* (See Front View, 61.)

(44.) *Flexor Longus Digitorum* arises from the posterior surface of the shaft of the tibia. The fibres terminate in a tendon, which runs behind the inner ankle, and, crossing obliquely the sole of the foot, divides into four tendons, which are inserted into the bases of the last phalanges of the four lesser toes. (Action, see below.)

(45.) *Flexor Longus Pollicis* arises from the internal surface of the shaft of the fibula, with the exception of an inch at its lowest part. The tendon of this muscle crosses the sole of the foot, to be inserted into the base of the last phalanx of the great toe. Action: The above two muscles are direct flexors of the toes or phalanges, and, continuing their action, extend the foot upon the leg.

(46.) *Tibialis Posticus* lies between the two preceding muscles. It arises from the shafts of the tibia and fibula. Its tendon passes behind the inner ankle, to be inserted into the scaphoid and internal cuneiform bones. Action is to extend the ankle; it also assists in turning the sole of the foot inwards.

(47.) *Os Calcis* is the largest and strongest of the tarsal bones, and is situated at the lower and back part of the foot, serving to transmit the weight of the body to the ground, and forming a strong lever for the muscles of the calf, to which they are attached.

(A.) *Coraco-brachialis.* (See Front View, 23.)

(D.) *Coccyx.*

Structure of Muscles. — Muscles are composed of fleshy bundles called *fasciculi*, enclosed in coverings of thin membrane, by which each is at once connected with, and isolated from, those adjacent to it. Each bundle is again divided into smaller ones, similarly ensheathed and similarly divisible; and so on, through an uncertain number of gradations, till one arrives at the *primitive* fasciculi, or the muscular *fibres*, particularly so called.

Muscular fibres consist, each of them, of a sheath of delicate, structureless membrane, called the *sarcolemma*, enclosing a number of filaments or fibrils.

The property of muscular tissue, by which its peculiar functions are exercised, is its contractility, which, in the contraction or shortening of muscles, is excited by all kinds of stimuli, applied either directly to the muscles, or indirectly to them through the medium of the motor-nerves. If this nervous influence, or blood supply, be cut off, the power of contraction in muscles soon ceases.

In shortening, muscles appear to swell up, becoming rounder, more prominent, harder, and apparently tougher. But this hardness of muscle in a state of contraction is not due to increased firmness or condensation of the muscular tissue, but to the increased tension to which the fibres, as well as their tendons and other tissues, are subjected from the resistance ordinarily opposed to their contraction.

Action of the Voluntary Muscles.—The greater part of the voluntary muscles of the body act as sources of power for moving-levers; the latter consisting of various bones to which the muscles are attached by strong white tissues, called tendons.

In the act of walking, almost every voluntary muscle in the body is brought into play, either directly for purposes of progression, or indirectly for the proper balancing of the head and trunk. The muscles of the arms are least concerned; but even these are, for the most part, in action.

Among the chief muscles engaged in the act of walking are those of the calf, which, by pulling up the heel, pull up also the large bone of the ankle-joint, and with it, of course, the whole body, the weight of which is transmitted through the bones of the leg. When starting to walk, say with the left leg, this raising of the body is not left entirely to the muscles of the left calf; but the trunk is thrown forward in such a way that it would fall prostrate, were it not that the right foot is brought forward and planted on the ground to support it. Thus the muscles of the calf are assisted in their action by those muscles on the front of the trunk and legs which, by their contractions, pull the body forwards; and of course, if the trunk form a slanting line with the inclination forwards, it is plain that, when the heel is raised by the calf muscles, the whole body will be raised and pushed obliquely forwards and upwards.

When the right foot has reached the ground, the action of the left leg has not ceased. The calf muscles of the latter continue to act, and, by pulling up the heel, throw the body still more forwards over the right leg, now bearing nearly the whole weight until it is time that in its turn the left leg should swing forwards, and the left foot be planted on the ground, to prevent the body from falling prostrate. Inasmuch as the body is being constantly supported and balanced on each leg alternately, and therefore only one at the same moment, it is evident that there must be some provision made for throwing the centre of gravity over the line of support formed by the bones of each leg; and this is done by rotation of the pelvis on the head of each thigh-bone in turn, in such a manner that the centre of gravity of the body shall fall over the foot of this side. The larger the pelvis, the greater has the rotation to be: this rotation, therefore, differs in each individual, being more in the female than the male. In the act of walking, one or the other foot is always on the ground; while running is a series of rapid low jumps with each leg alternately, so that, during each complete act, there is a moment when both feet are off the ground.

The nervous supply to the muscles is very large, each muscular fibre having a nerve-branch. Should anything interfere with the nervous supply, as from disease of the spinal cord or brain, paralysis of the muscles results.

HAIR.—The hair is a peculiar modification of the scarf-skin, and its structure is essentially the same as of that membrane. It is found on every part of the surface of the body, excepting the palms of the hands and the soles of the feet; but it varies very much in length, thickness, and color in the different parts. Black hair is due to an excess of *iron* in its composition; red hair, to *sulphur*, etc. *Curly* hair differs from *straight* hair in being flat in shape, whereas the latter is round.

Structure of Hair. — Externally it is covered by a layer of fine, flattened cells, which overlap one another like the tiles of a house, their free margins being turned upwards. This outer layer is called the *cuticle* of the hair. Beneath this is a much thicker layer of elongated, horny cells, closely packed together. In some cases, there is left a central space in the hair filled with a substance called *medulla*, or pith, composed of small cells containing fat and pigment granules.

The hair terminates in a tubular depression in the surface of the skin, called its *follicle* (see "Skin"). At the bottom of this follicle is a small *papilla*, or projection of true skin: it is from this that the hair grows. The enlarged part of the hair where it joins the papilla is called its root or bulb.

The hair is being constantly cast off; and, as long as the papillæ are in a healthy state, a new growth of hair will spring up in its place. Should, however, the nutrition of the skin be interfered with or the papillæ be destroyed, there is no new growth, and baldness is the result.

The hair should always be kept scrupulously clean; and children's hair should be cut short, and be washed with soap and water three or four times a week. When the hair is short it soon dries, so that there is little liability of the child catching cold. Long hair is a luxury, and its preservation requires careful attention. The hair itself ought to be carefully combed and brushed, and the scalp should be kept clean. The best application that can be made to the head is plain soap and water, afterwards rinsing the hair in soft water. The soap made from glycerine is the best for this purpose. The shampooing mixtures commonly sold, as well as ammonia, had better not be used, as they remove all the oily matter from the head and render it brittle. When oily substances are used, they should be of a kind not likely to become rancid. Four ounces of glycerine dissolved in twelve ounces of rose-water is a very suitable preparation, as are also the hair-salves composed of vasaline.

Dandruff is frequently caused by irritating the scalp by the use of a hard brush. For the removal of dandruff, the white of an egg rubbed thoroughly into the scalp, and then washed out, is said to be efficacious. For *alopecia*, or premature loss of hair, many remedies are in vogue. Shaving the head repeatedly after an illness may often save the hair. Stimulating applications, such as hair tonics, sometimes help, but at other times injure the hair. The following are the safest and most efficacious remedies: —

Aromatic spirits of ammonia, spirits of rosemary and glycerine, each two ounces; tincture of cantharides, six drachms; and sufficient rose-water to make sixteen ounces altogether, — to be applied once or twice a day. Or, —

Balsam of tolu, two drachms; oil of rosemary, twenty drops; tincture of cantharides, two drachms; castor oil, half an ounce; vasaline, one ounce.

This may be used as an ordinary pomade. Hair-dyes should be strictly avoided, as they invariably contain substances that are very deleterious to the system, as well as to the hair itself. Sage-tea, in which a little borax has been dissolved, applied to the hair by means of a sponge at the time of dressing the hair, will frequently prevent its turning prematurely gray.

NAILS. — The nails are flattened, elastic structures of a horny texture, placed at the extremities of the fingers and toes.

The nail is implanted, by a portion called the *root*, into a groove in the skin; and the part beneath the nail is called the matrix, because it is the part from which the nail is produced.

The chemical composition of the nails is very similar to that of the skin, except that they contain a larger portion of carbon and sulphur.

Care of the Nails. — A pretty, well-formed nail is an ornament to the finger. It need scarcely be said that the accumulation of filth under the nails does not add to their beauty, but it is not so generally known that it may be the source of unhealthiness. The nails should always be kept clean, especially in those who work amongst poisonous materials.

Roughness, or spots about the nails, may be removed by rubbing them with *pumice-stone.* There are many useful little appliances for dressing the nails, and the care of the nails has been made a special art under the name of *manicure.*

MUCOUS MEMBRANES.—These line all passages by which the internal parts communicate with the exterior, and by which matters are either eliminated from the body, or foreign substances are taken into it.

In structure they are soft and velvety, containing a large number of blood-vessels, nerves, and lymphatics.

Their surfaces are covered with variously shaped cells, called *epithelium*, which secrete a thick substance known as mucus. When the membrane is inflamed, this mucus becomes very abundant, as seen in catarrh. The most interesting of the epithelium is that which goes under the name of *ciliated* epithelium. These have their exposed portions covered with small, hair-like processes. If a portion of the mucous membrane of a living or recently dead animal be removed from the eye or windpipe, and be moistened and examined under a microscope, the cilia or hair-like processes are observed to be in constant motion, moving continually backwards and forwards, alternately rising and falling with a lashing or fanning movement. The appearance is not unlike that of the waves in a field of corn, agitated by a breeze. The general result of their movements is to produce a continuous current towards the external orifice. Thus it is that the mucus which has formed in the windpipe is brought up to the throat, and dust or sand under the lid is propelled to the inner angle of the eye.

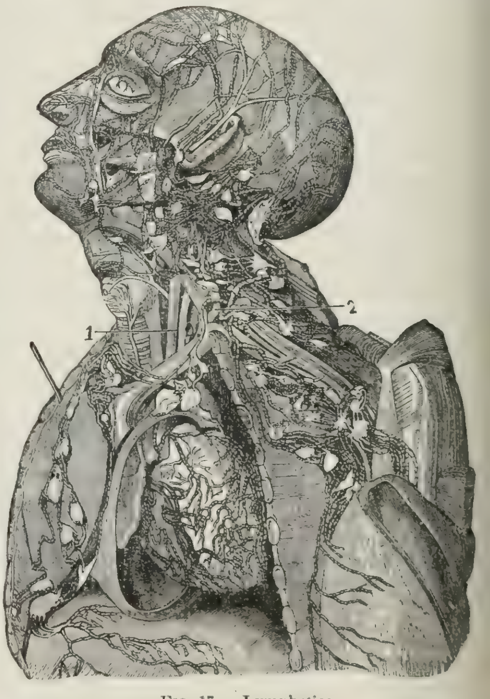


FIG. 17. — Lymphatics.

Lymphatic Vessels and Glands of the Head, Neck, and Upper Part of the Trunk. 1 and 2, Thoracic duct, forming an arch.

LYMPHATIC VESSELS AND GLANDS (Fig. 17). — The lymphatics are simply a part of the great system of vessels or channels found in almost every part of the human body. Distributed around the intestines, they have been already spoken of under the head of *Lacteals.* In the skin, muscles, and internal organs, they begin as a network of fine, hair-like tubes. These collect together, forming two trunks, which empty their contents into the large vein situated under the left collar-bone.

The function of the lymphatic vessels is to collect from the skin, muscles, and internal organs, etc., the excess of fluids which have passed out of the arteries, and to convey it back to the blood. This fluid is clear and transparent, and is called lymph.

Lymphatic Glands. — Almost all lymphatic or lacteal vessels, in some part of their course, pass through one or more small bodies called lymphatic glands. These glands about the neck often become enlarged in *scrofulous* children, and in the groin in certain diseases. The use of these glands is supposed to be to assist in the formation of corpuscles of the blood; also to induce certain chemical changes in the lymph passing through them.

SKIN (Fig. 18). — The skin is composed of two layers,— First, the scarf-skin or *cuticle*, which is the thin outer layer that is sometimes rubbed off by an abrasion, or raised by the action of a blister. This outer skin is constantly being shed and replaced by new material. It is made up of small cells flattened together. Second, the true skin or *derma:* this is composed of a number of fibres arranged in a network fashion. Between this network are placed the blood-vessels, nerves, and numerous small bodies called glands. In the derma, and immediately beneath the scarf-skin, are a number of small finger-like processes called *papillæ*, or touch-corpuscles. It is in these that the nerve terminates.

The pigment that gives the different colors to the skin is situated over the whole of the true skin, and immediately under the scarf-skin.

Opening from the exterior surface of the skin are little tubes called *pores*, which penetrate downwards, in a corkscrew fashion, for a quarter of an inch, and then curl up into little balls. These latter are the *sudoriferous* glands, which secrete the perspiration. The number of the pores in the skin is estimated to be two thousand eight hundred to the square inch, and, if put in one continuous tube, would measure altogether twenty-eight miles in length. They are most numerous in the palms of the hands and the soles of the feet.

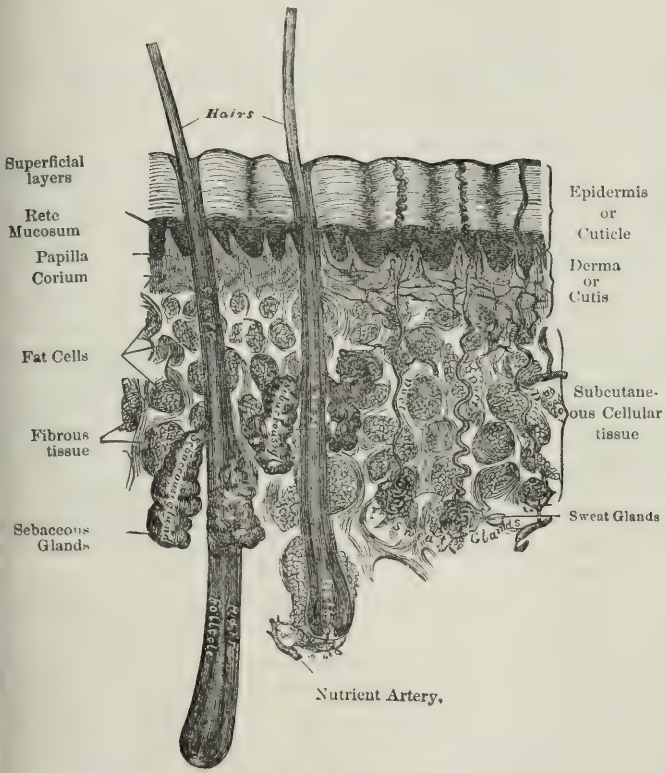


FIG. 18. — The Skin.
A Sectional View of the Skin (magnified).

Over most of the body *hair* is present. The place where it is lodged in the skin is called the *follicle.* These follicles are deep, and extend nearly the whole thickness of the true skin; and they are lined by the scarf-skin, which passes down into them. At the bottom of each hair-follicle is a little elevation named the *papilla:* it is from this point that the hair grows.

On each side of the hair-follicle are two little glands, called the *sebaceous* glands, and running from them into the hair-follicles are little tubes. These tubes give passage to oily matters, which soften the hair and skin.

After having seen the structure of the skin, we will notice its functions:—

1. It is a protecting covering for the whole body.
2. It is the seat of the termination of certain nerves whereby all degrees and varieties of sensation, touch, and temperature are transmitted.
3. It has the function of absorbing matters.
4. It assists the lungs in expelling carbonic acid.
5. It regulates the temperature of the body.
6. It assists the kidneys in expelling water and urea.

From the complexity of its functions it will be seen that, if anything interferes with the action of the skin, not only are skin troubles produced, but the whole system suffers. One of the most potent and frequent sources of disease is want of cleanliness.

If the scarf-skin, which is constantly being thrown off, should collect and block up the pores, extra work would be entailed on the lungs and kidneys; and, if these are weak from overwork, then those substances which should be removed would remain in the blood, producing various kinds of symptoms, such as headache, dyspepsia, languor, etc. The skin, therefore, should be kept scrupulously clean, to allow its assistance to the other excreting organs, and this should be done by frequent baths.

Bathing should be performed three to four times a week at least, and every day if possible. The water should be of a pleasant temperature, and soap should be used. Never use common soap on the skin, as it usually contains an excess of alkali: glycerine soap is the best in use. Morning or evening is the best and most convenient time for bathing. Bright articles of clothing, dyed with *aniline* dye, should never be placed next the skin. Patent cosmetics and skin and hair washes injure and do not improve the skin, and also, from absorption of the poisonous substances usually contained in them, injure the system. In a healthy person who attends regularly to the rules of health, the skin is of a healthy hue, and soft in texture; but there are some affections which disfigure from various causes, of which we will speak further on, and give remedies for their relief.

SKIN DISEASES have many names, but, from the similarity of treatment of many of them, we will divide them into classes:—

1. Those that commence as small *blisters*, which afterwards break and form a *scab* or crust, *eczema* and *herpes* being the medical terms. The following are the names commonly used: Baker's itch, washerwoman's itch, brick-layer's itch, grocer's itch, saltrheum, bath-itch, fever-blisters, cold-sores, shingles, brow-shingles, milk-crust, tetter, etc. *Treatment.*—The crust should be removed by softening with oil, or a poultice may be applied; the part should then be thoroughly washed with tar-soap, and oxide of zinc ointment be applied. This should be done twice a day.

The diet should be light,—meat only once a day; no spices or pepper should be used, nor stimulants. The bowels should be kept freely open with mineral water, or citrate of magnesia. In obstinate cases, Fowler's solution of arsenic should be taken. In children of a weakly constitution, cod-liver oil may be taken internally; also applied to the eruption, which application relieves the itching.

Ringworm is quite common in children, its favorite seat being on the head or face. It begins as a little ring of blisters, which increases in size, leaving its centre dry with a branny surface: it is marked, if on the head, by destruction of the hair, which drops out in circular patches. *Treatment.* — Paint the part with equal parts of tincture of iodine and water; afterwards tar or mercury ointment may be applied.

2. The *second* class are those in which lumpy elevations are formed without any discharge. The medical terms are *erythema, urticaria,* and *roseola.* The common names are nettle-rash, prickly heat, hives, night, winter, and ground itch, and rose-rash. *Treatment.* — The diet should be the same as in the first class, and a bottle of magnesia citrate should be taken, and also small doses of charcoal. Wash the parts with vinegar, and powder arrowroot over the surface. In *ground itch,* bathing the feet in brine, or rubbing common soap between the toes before retiring, will be found efficacious.

Army itch should be treated with a lotion composed of iodide of potash, one half ounce; iodide of sulphur, one drachm; glycerine, two ounces.

The True Itch or Scabies. — This may be known by the constant itching. The scabies appear as little elevations with a white or watery top, and running from them little red lines. *Treatment.* — Take a warm bath at night, and immediately apply sulphur ointment. This may be repeated the following evening if necessary, but one application usually suffices.

Barber's Itch or Cycosis. — Clip the hair close, and sponge several times a day with castile soap, and apply iodide of lead ointment, or nitrate of mercury ointment.

Pimples or Lichen usually appear about the face. Wash the face in warm water in the evening, and apply lac sulphur, which should remain on all night; light diet should be taken, and bowels kept open.

Black-heads or Acne. — Apply ether once or twice a day to the part affected, which is usually the forehead or nose.

Mother's Mark and Moles (*Nevus*) require a surgical operation to remove them.

Sunburn, Freckles, and discolored spots about the face, may be removed by diluted nitro-muriatic acid, thirty drops in an ounce of water; this should be left on for some time before wiping the face.

Chilblains are occasioned by warming the feet too quickly when cold. Painting the parts with tincture of capsicum, or the application of cabbage-leaves, will give relief.

Chapped hands are often occasioned by not drying them sufficiently after washing. Cold cream applied, or the following mixture will be efficacious: —

> Bay-rum and glycerine, each one part; quince-juice jelly, two parts; mix and apply. The oil of rose (three drops) may be added to give it a pleasant scent.

Cracked lips may be treated same as above.

Itching without eruption may be relieved by whiskey and common salt mixed together, and applied; or hydrochloric acid, twenty drops in four ounces of water. Itching about hairy surfaces is often due to lice: they may be destroyed by the application of mercury ointment.

Corns and Warts. — Apply glacial acetic acid every evening until they disappear. If a corn inflames, poultice it with bread and milk; a few drops of laudanum mixed with the poultice give relief from pain.

Ulcers may be situated on any part of the body, their usual seat, however, being on the legs. Ulcers occasioned by a blow, in a healthy person, heal rapidly.

Varicose Ulcers require rest. The ulcer should be painted with Canada balsam, and over this be dusted iodoform. By strapping the ulcer as in the accompanying cut (Fig. 19), and applying a bandage (the best kind being flannel or rubber), a cure may be effected.

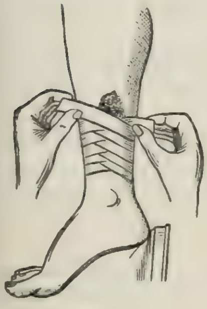


FIG. 19.

Boils may be prevented from forming by the application of hot water to the part, by means of a piece of flannel. Should they resist this treatment, they may be poulticed, and be opened with the sharp point of a pair of scissors, as soon as they form a head. If they come in crops, tincture of iron, ten drops three times a day, should be taken.

BONES.—The entire skeleton in the adult consists of 200 distinct bones. These are:—

The spine or vertebral column (including sacrum and coccyx), 26; cranium, 8; face, 14; os hyoids, sternum, and ribs, 26; upper extremities, 64; lower extremities, 62: total, 200.

In this enumeration, patellæ are included as separate bones; but the smaller sesamoid bones and the ossicula auditûs are not reckoned.

SKELETON, BACK VIEW.—FIG. 20.

1. Parietal; 2. Occipital; 3. Frontal; 4. Malar; 5. Inferior maxillary or lower jawbone; 6. Atlas or first cervical vertebra; 7. Vertebra prominens, or seventh cervical vertebra; 8. First dorsal vertebra; 9. Twelfth dorsal, first lumbar vertebra; 10. Coccyx; 11. Sacrum; 12. Os innominatum; 13. First rib; 14. Twelfth and last rib; 15. Clavicle or collar-bone; 16. Scapula or shoulder-bone; 17. Humerus; 18. Ulna; 19. Radius; 20. Carpal bones, 7; 21. Metacarpal, 5; 22. Phalanges, 14; 23. Femur; 24. Tibia; 25. Fibula; 26. Tarsus, 7; 27. Metatarsus, 5; 28. Phalanges, 14.

SKELETON, FRONT VIEW.—FIG. 21.

1. Frontal; 2. Nasal; 3. Malar; 4. Temporal; 5. Superior maxillary, or upper jaw; 6. Inferior maxillary, or lower jaw; 7. Mastoid process; 8. Last cervical vertebra; 9. First dorsal vertebra; 10. Acromion process of the scapula, 12; 11. Coracoid process of the scapula; 12. Scapula; 13. Humerus; 14. Manubrium, or first piece of sternum; 15. Sternum, or breast-bone; 16. Ensiform, or third piece; 17. Cartilage of sixth rib; 18. Eleventh rib; 19. Twelfth rib; 20. First lumbar vertebra; 21. Sacrum; 22, 23, 24. Pelvis; 22. Ilium, 23. Pubes; 24. Ischium; 25. Ulna; 26. Radius; 27. Carpus; 28. Metacarpus; 29. Phalanges; 30. Femur; 31. Patella; 32. Fibula; 33. Tibia; 34. Tarsus; 35. Metatarsus; 36. Phalanges.

Bones are connected together by *ligaments*. From their shapes, they have been called long, short, flat, and irregular. They are composed of earthy and animal matter. The earthy matter is mostly composed of phosphate of lime,—sixty-seven per cent of the latter; animal matters, thirty-three per cent. Long bones are hollow, and filled with a fatty matter; the others, solid. If we place a section of bone under the microscope (Fig. 22), there will be noticed little canals running in a longitudinal direction. These are named *Haversian* canals, and around these canals the bone is placed in layers in the form of rings. Branching in all directions from these canals are smaller little tubes called *canaliculi*. These canaliculi end in little pouches named *lacunæ*. All these small canals and pouches are filled with a fluid which nourishes the bone.

On the outside of all bones, except at their ends, is a membrane which has received the name of *periosteum*.

The object of bones is, to protect the vital organs, to give a framework to the body, and by the action of muscles to produce locomotion.

Diseases of Bones are numerous: death of the bone is called *necrosis*, and gradual decay, *caries;* fractures also are common. As soon as bones are fractured, they throw out new bone, which cements the broken ends together.

Necrosis and Caries usually affect the shin bones, although all bones are subject to it. It is known by violent pain at one spot; the skin over it becomes purple and mottled, and after a little time small ulcers form, which run down to the bone and give exit to pus or matter. The treatment requires skilful surgery.

FRACTURES.—It is not the object of these pages to recommend self-treatment, but only to assist in those cases where medical advice cannot be obtained, or, in other words, cases of emergency.

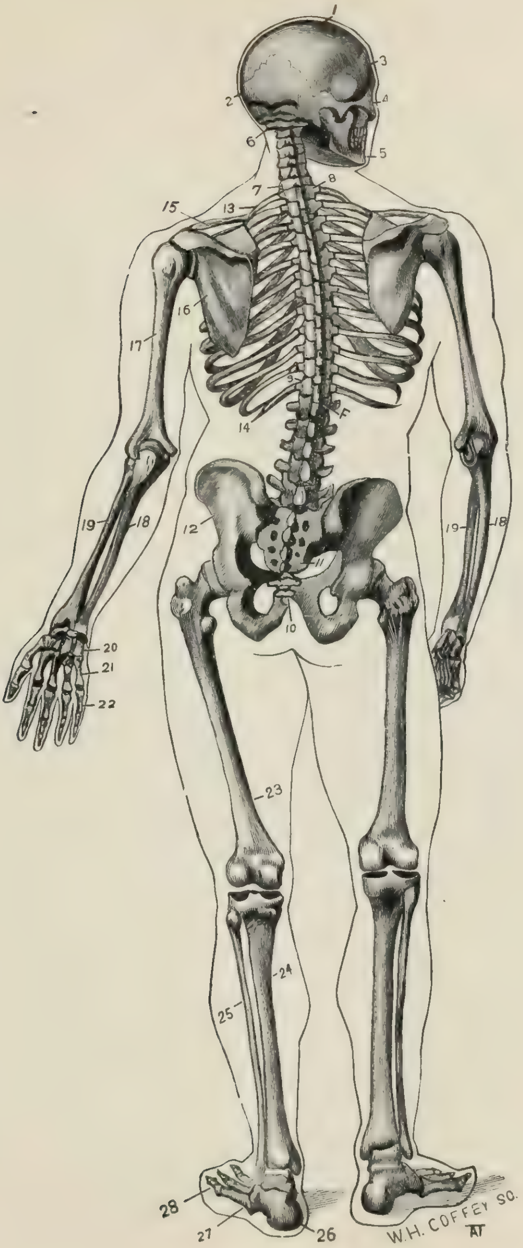


Fig. 20. — Skeleton (Back View).

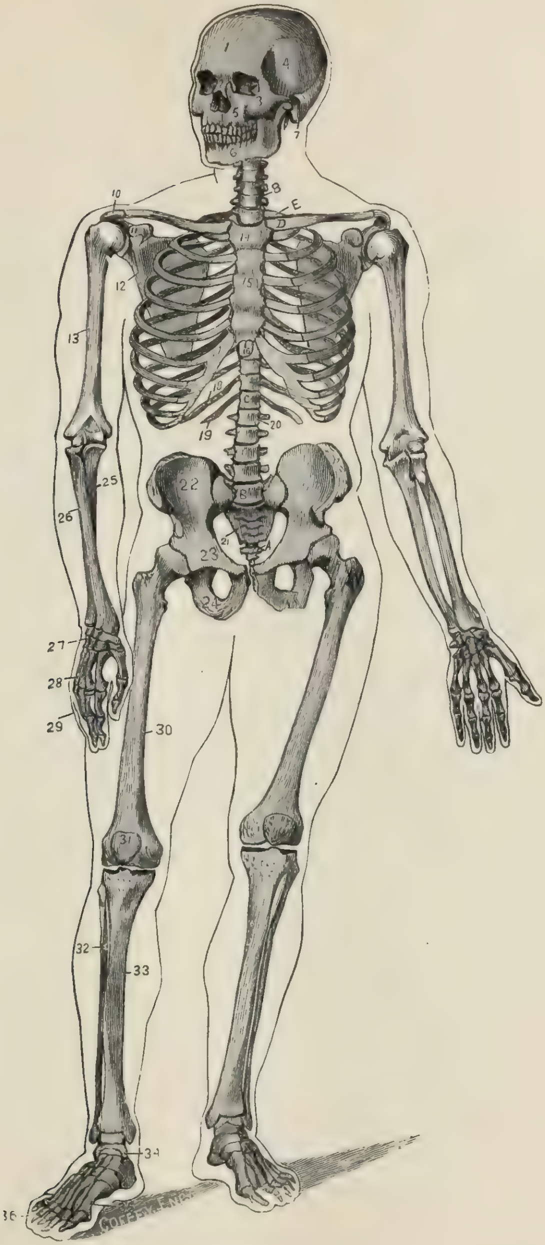


Fig. 21. — Skeleton (Front View).

Fractures of the Skull are dangerous, and often prove fatal immediately after their receipt. If the fracture be at the base of the skull, there will be bleeding from the nose, ears, and around the eyes. The condition of the patient is usually that of unconsciousness, flushed face, full pulse, and stertorous breathing or snoring. *Treatment.* — Ice applied to the head, and a drop of croton-oil rubbed up with butter placed on the back of the tongue; or an injection of soapsuds into the lower bowel; potass bromide, ten grains every four hours. By this time a surgeon should be at hand.

Fracture of the Collar-bone is known by the shoulder dropping. By running the finger along the collar-bone and pressing gently, you will be enabled to feel the rough ends of the bone rub together. *Treatment.* — Pull the shoulders well back by passing a handkerchief over both shoulders and under the armpit and tie behind; next place a soft towel, rolled up, under the armpit on the affected side; bandage the arm to side, and support elbow in a sling passed around the neck.

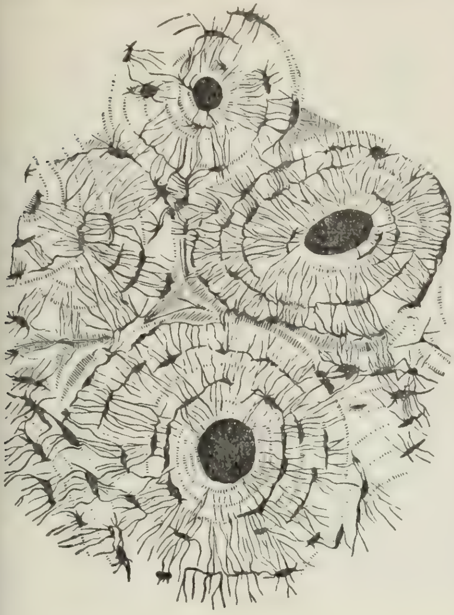


FIG. 22. — Bone.

Transverse section of compact tissue (of humerus), magnified about one hundred and fifty diameters. Three of the Haversian canals are seen, with their concentric rings; also the corpuscles or lacunæ, with the canaliculi extending from them across the direction of the lamellæ. The Haversian apertures had got filled with débris in grinding down the section, and therefore appear black in the figure, which represents the object as viewed with transmitted light (after Sharkey).

Fracture of the Arm is known by no change about the shoulder, except that the arm is shorter than the other; great pain on moving the arm; the arm will lengthen on pulling it, but shorten immediately after the pulling has ceased. *Treatment.*— Apply three pieces of board well padded with cotton-batting or old blanket. These splints should extend from the shoulder to the elbow; one applied from the armpit to the bend of the elbow, on the inner side of the arm; one on the outer side, and another behind. Keep these on with a bandage, and suspend hand in a sling.

Fracture of the Forearm.— One or both bones may be broken. There will be pain about the seat of fracture, and by gently moving the arm the broken bones will be felt to rub together. *Treatment.* — Apply two splints well padded, one on the outer and another on the inner side of the forearm: they should extend from the elbow to the commencement of the fingers. The forearm and hand should be next bandaged, beginning at the hand; suspend the arm in a sling.

Fracture of the Bones in the Palms of the Hands. — A ball of yarn of good size should be placed in the hand, the fingers being closed over it, and a bandage applied.

Fracture of the Fingers. — Apply two strips of pasteboard, one in front and another behind the finger, and retain them on with strips of adhesive plaster.

Fracture of Ribs. — This usually occurs by some heavy weight passing over the chest or back. It is known by great pain on pressing the side, and on drawing a full breath, a stitch-like pain in the side; also a short, suppressed cough. *Treatment.* — Apply a number of strips of adhesive plaster about one inch wide, extending from the spine to the breast-bone; the whole side should be well covered; keep patient very quiet. If bleeding from the lung occurs through the mouth, give ice to suck and ten grains tannic acid, until the doctor arrives. Pleurisy or pneumonia often follows.

Fracture of the Thigh Bones is known by the toes being turned outwards, and great pain on movement of the limb. Great care should be exercised in lifting, or removing clothes, should the limb be broken. Tie both lower limbs together before lifting; as soon as possible, the patient should be placed on a hard bed (not feathers), and a long splint well padded, extending from the armpit to the foot, be applied, and retained by bandages, commencing at the foot and extending to the groin. Another bandage should be applied around the body to keep the splint well to the side.

Fracture of the Bones of the Leg.—One or both of these bones may be broken. Pain and tenderness at the seat of fracture, and on movement of the foot a grating feeling of the bones rubbing together, will make it known. *Treatment.*—Apply two splints well padded on the inner and outer side of the leg, from the knee to below the heel. Apply a bandage from the toes to knee, and keep patient in bed.

Fracture of the Bones of the Foot and Toes requires no special treatment except rest in bed. A carefully applied bandage, not too tight, would be beneficial.

Fracture of the Nose often occurs from a fall upon the face, and is easily known. *Treatment.*—Roll two pieces of lint of sufficient size to fit each nostril snugly; oil and press them as far backwards as possible into the nostrils. This will lift the broken fragments upwards. Adhesive plaster should next be applied across the bridge of the nose.

Fracture of the Lower Jaw can be told by the grating feeling and pain on pressing upon the seat of the fracture. *Treatment.*—Take a piece of pasteboard, sufficient to extend from the chin to the angle of the jaw, and about two inches wide; this should be soaked in hot water until soft, and moulded to the jaw; apply it with a bandage to keep it on. Only fluid food should be taken for some time, until the bone unites.

After applying a splint, it should remain on for four weeks for large bones, and three weeks for smaller ones.

On removal of splints, the joints of the fractured limb will be stiff. This may be overcome by rubbing with stimulating liniments, such as camphor liniment, etc., and by moving the joint constantly. The swelling occurring after a splint is removed from the lower limb may be removed by bathing the limb well in water two or three times a day, rubbing it carefully with oil, and applying a flannel bandage.

Joints.—Joints are composed of two or more bones placed in apposition, the bones being held together by fibrous bands called ligaments. Between the two opposing surfaces is a *sac* containing a fluid resembling the white of an egg; this is called the *synovial sac.* Around joints also, where the muscles or tendons of the muscles pass, are little bags containing fluid known as *bursœ.*

Having briefly described the structure of joints, we will now take a hasty glance at some of the diseases and injuries they are subject to.

Hip-joint Disease is a scrofulous disease usually occurring in children, but sometimes met with in adults. The early symptoms are a slight pain in the knee, and lameness in walking, together with some swelling about the hip. The knee soon points inwards, and the foot become inverted and turns in; the pelvis becomes tilted to one side, and so the diseased leg appears shorter than the sound one. *Treatment.*—Perfect rest, good diet, cod-liver oil, etc.

Swelling of the Knee, or *Ankle* (*Synovitis*), may be due to a blow, but may also follow exposure to cold and wet. The injured part becomes hot and painful, and swelling increases rapidly. When looked at first, the swelling of the knee has somewhat the appearance of a horseshoe with its heels on each side of the knee-cap. *Treatment.*—A warm poultice of linseed meal should be constantly applied to the part; a little laudanum mixed with it will assist in relieving the pain. The leg should be placed in a splint well padded, and a bandage applied. Bowels should be kept open, together with a light diet.

White Swelling of the Knee comes on slowly, although it may be increased by a blow or sprain. When fully established, the swelling about the knee appears white with veins crossing it. The skin becomes doughy. *Treatment.* — The knee should be kept perfectly quiet by a splint applied behind, the knee being bent a little forward by a pad just behind the joint. With the best results, the joint of the knee will remain stiff afterwards. Good diet and cod-liver oil should be taken.

Housemaid's Knee. Treatment. — Paint the part with iodine and apply a bandage; rest should be taken, and the knee kept from bending as much as possible.

Dislocation of the Lower Jaw is easily known. *Treatment.* — Cover the two thumbs with a napkin, and introduce them into the mouth as far back as the last grinder; push downwards and backwards, and at the same time lift the chin with the little and ring fingers. As soon as reduced, apply a bandage, and take only fluid food for some days.

Dislocation of the Shoulder-joint. — The shoulder looks flat, and the head of the bone can be felt in its new position; the arm cannot be moved, and there is swelling about the joint. *Treatment* (Fig. 23). — Place the patient on the floor on his back; sit on the floor facing him, and remove the boot from the foot nearest to him; grasp the dislocated limb at the wrist, and place the uncovered heel into the armpit, drawing the arm slowly downwards, and at the same time pressing steadily with the foot under the arm. If successful, the joint will be felt to slip into its right position.

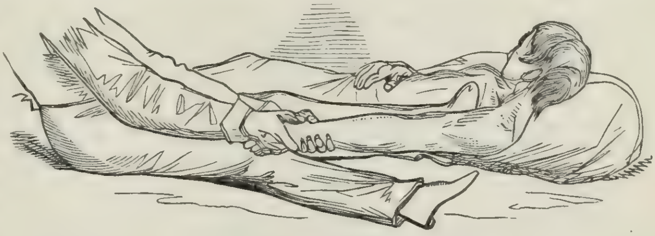


Fig. 23. — Reducing an Arm out of Joint.

The arm should be now bandaged to side, and retained so for two weeks. Pain and swelling may be subdued with cold water constantly applied.

Dislocation of Elbow is early seen and felt. *Treatment.* — Seat the patient on a chair, and put your foot on the chair between his legs; then bend the arm and pull towards you. As soon as it has been replaced, a splint like the letter L should be applied upon the elbow, and kept on for two weeks.

Dislocation of Wrist. Treatment. — With one hand on the forearm of the patient, and another grasping his hand, try to separate the bones at the wrist. If successful, the bones will be replaced and the deformity be reduced. Apply a splint, and retain it on for eight or ten days.

Dislocation of Hip-joint. — This will require a competent surgeon to reduce.

Dislocation of Knee-cap. — Straighten the leg as much as possible, and push the bone into its right position.

Dislocation of the Knee-joint rarely occurs; when it does, it may be replaced by flexing the thigh towards the body, at the same time having some one to grasp the leg above the knee firmly, while you pull downwards from the ankle. Apply a splint, and keep quiet for two weeks.

Dislocation of Ankle-joint. — Grasp the heel with one hand and the instep with the other, and then pull towards you until the bones slip into their right position. The joint should be kept quiet for eight or ten days afterwards.

Dislocation of Fingers may be reduced by pulling them sharply. Although we give rules for the reduction of joints, it will be found often impossible to replace a limb in a strong muscular man without the use of ether, in which case, of course, a surgeon should be called.

Sprains of the Wrist and Ankle. — Place the sprained part in hot water, and keep it there for twenty to thirty minutes. After removal, tincture of arnica or vinegar may be rubbed on, and the part bandaged.

WOUNDS. — Wounds are divided into three classes, — *Incised*, made by a sharp cutting instrument, *Contused and Lacerated*, made by a blunt instrument; and *Punctured*, made by a sharp-pointed instrument. *Treatment.* — *Incised* wounds should be brought together with plaster after bleeding has ceased. The way to apply adhesive plaster is to take strips about three quarters of an inch wide, and sufficient length to go half-way around the limb; after heating, apply it to the skin, a good distance from the wound, and with the right hand pull the strip, while with the other bring the wound well together, and then apply the other half of the plaster to the skin.

Contused and Lacerated Wounds bleed but little. The wound should be thoroughly washed, and all dirt removed; pieces of linen constantly kept wet with a solution of water and carbolic acid (just enough acid to give the water a scent) should be placed over the wound, and over this should be placed a piece of oiled silk. If it get offensive in odor, a poultice of flax-seed meal may be applied with benefit.

Punctured Wounds should be covered with a piece of linen saturated with a solution of carbolic acid and water. It is important that the wound should not be allowed to heal above while remaining unhealed below the surface, as in that case an abscess is likely to form. If the edges of the wound come together and adhere, while around it is still swollen and doughy to the touch, it will be well then to apply a poultice.

Scalp Wounds. — The hair should be removed from around the wound, the wound carefully washed, and closed together with plaster. If it should close up but contain matter beneath, it should then be poulticed, as erysipelas may ensue if it be not done.

BLEEDING, AND HOW TO CHECK IT. — *Bleeding from the Nose.* — This may be stopped by pressing the nostrils firmly together for some minutes. Ice applied to the bridge of the nose or nape of the neck; snuffing up into the nostrils ice-water, vinegar, gum-arabic powder, or tannic acid, are all of them available means to check the effusion.

From the Lungs. — Ice sucked in the mouth, or ten grains of gallic acid, or fifteen drops of aromatic sulphuric acid in cold water, are all beneficial.

From the Gums. — Known as "spongy gums." Washing the mouth with tincture of myrrh and water will harden the gums and prevent the bleeding.

From the Bowels. — Pieces of ice introduced into the lower bowel, or an injection of iced water; or, in more serious cases (such as typhoid fever, etc.), an injection of starch and laudanum, or starch and turpentine (about twenty drops of the latter to an ounce of starch), will be serviceable.

Bleeding from the Tongue. — Wash the mouth out with alum-water.

Bleeding from the Finger may be stopped by pressing the finger on each side.

Bleeding from a Superficial Cut may readily be stopped by applying ice, or direct pressure over the spot by the finger; oil of turpentine and vinegar are also serviceable.

Bleeding from a Deep Cut, when the blood flows profusely and comes in jets and is scarlet, this should be stopped by pressing the large artery supplying the part. If the wound be in the armpit, press your thumb firmly on the neck behind the collar-bone, about its centre; or take a door-key, and, after folding a handkerchief over it, press downwards on the same place.

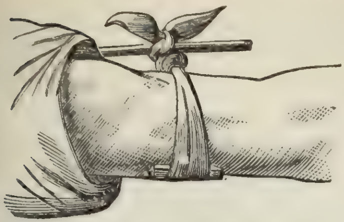


FIG. 24. — Handkerchief Tourniquet on the Arm.

Bleeding, when profuse, from the extremities, may be checked until assistance arrives by tying a handkerchief around the limb above the wound, and twisting it with a stick placed under it, until it is tight and bleeding has ceased (Fig. 24).

Bursting of Enlarged or Varicose Veins, usually in the leg. *Treatment.*—Place a pad of some material over the bleeding point, and bandage the leg from toes to knee. Keep quiet, with foot well elevated, for a few days. Persons suffering from varicose veins should wear an elastic laced stocking, or apply a well-fitting bandage. Rubber bandages are also excellent.

SPLINTERS, NEEDLES, THORNS, etc., in the flesh should be removed if possible. If you can feel them, cut down to them with a sharp knife and lift them out; otherwise, apply a bread-and-milk poultice. Stings from hornets, wasps, bees, or mosquitoes may be relieved by washing the part with vinegar, or by rubbing the spot with a mixture of baking-soda and common salt in about equal parts.

TO PREVENT MOSQUITOES FROM BITING, sprinkle a few drops of oil of cloves around your clothes; or oil of cloves, one drachm, and vasaline, one ounce. This may be rubbed over the hands and face.

GANGLIA, OR SWELLINGS AT THE BACK OF THE WRIST, may be dispersed when they first appear by striking them with a book, or other smooth, hard surface. If of long standing, paint with iodine.

TO REMOVE A TIGHT RING FROM THE FINGER, take some strong thread and twist it around the finger from the tip; when you have arrived at the ring, pass the thread under it. Soap well the finger, and untwist the thread. This will carry the ring with it.

FOREIGN BODIES IN THE NOSE. — Take a hairpin, and bend its head to one side so as to form a sort of hook, and then insert it into the nostril, passing it over the body, and pull it gently out. By closing one nostril and blowing through the other nostril, foreign substances may usually be expelled without difficulty.

OBSTRUCTIONS IN THE THROAT, GULLET, AND WINDPIPE. — To remove these, the body should be bent as much as possible, and several sharp blows applied to the back between the shoulders. Another way is to pass the fingers into the throat, and thus directly remove the substance. In the case of a child, it should be lifted by the feet, with its head downwards, and a sharp blow administered between the shoulders. An emetic may also be used successfully, or diluted vinegar; also, the white of an egg in case of obstruction by fish-bones, etc.

FOREIGN BODIES IN THE EYE, such as cinders, particles of dust, etc., are usually situated under the upper lid, and the best way to remove them is by holding a knitting-needle or match over the upper lid, seizing the eyelashes and pulling the lid gently forwards and upwards. This will usually reveal the irritating particle, and it can be then removed by the corner of a silk or cambric handkerchief. If the eye be inflamed, bathe it with a solution of borax (one drachm) in a pint of water; or a few drops of a solution of morphia may be dropped into the eye.

Foreign Bodies in the Ear. — Insects sometimes get into the ear, and cause much inconvenience. The best mode of procedure in such cases is to fill the ear with sweet oil, which will kill the animal and generally float it out; but, if it be not thus removed, it must be washed out with a syringe and warm water.

Beans, Peas, Pebbles, etc., sometimes get into the ears of children, but it should never be attempted to remove them with pins, knitting-needles, sticks, etc. The rounded end of a hairpin may be sometimes used, but the safest way is to employ a syringe and warm water. Wax should be removed by pouring warm glycerine into the ear; but picking it with sharp substances should be avoided, as it may permanently injure the ear.

Fish-hooks, Needles, etc. — Needles are sometimes difficult of extraction after entering the flesh. It is well perhaps to make an incision to remove the needle, if it can be felt; otherwise, apply a poultice. When a fish-hook has plunged its barbed point into the flesh, its hasp must be pushed forward until the barb presents itself, which can be cut off with a pair of strong scissors, and then the hook can be easily withdrawn.

Splinters or Thorns should be removed by cutting the flesh above them with a sharp knife and lifting them out, or by the application of a poultice.

Teeth that have been knocked out by accident should be immediately replaced in their sockets, and fastened by a thread to the teeth on either side. By this precaution they may regain their position and usefulness.

Bites. — The bite of a *dog* is often dangerous on account of the possibility of hydrophobia or rabies, and therefore should be promptly attended to. The following precautions are advisable: —

1st, to tie a string tightly around the part bitten, which is usually an arm or leg; 2d, to wash the wound thoroughly, or cleanse it by suction; 3d, the wound should then be cauterized by lunar caustic, or bichromate of potash. In the absence of these, a red-hot poker or live coals may do. After this is done, a light poultice should be placed on the wound.

In *bites of rattlesnakes, vipers*, etc., the same remedies are applicable. In the latter case, however, stimulants are often required, as alcohol, or aromatic spirits of ammonia.

Burns and Scalds vary in degree. The best treatment is to apply a thick coating of bicarbonate of soda (baking soda or saleratus) to the burned part, and over this should be placed cotton-batting; equal parts of lime-water and linseed-oil may be used, or carbolized oil, — ten grains of carbolic acid to an ounce of olive-oil. If symptoms of fainting are present, apply hot bottles to the feet, and give stimulants with a few drops of laudanum.

To Prevent substances from taking Fire, rinse the substances in water in which a piece of alum has been dissolved. This should be always done with children's summer dresses, and also the dresses of those who use oil in lighting their fires. We may state that fully seventy-five per cent of the deaths that occur from fires in domestic households arises from the habit of lighting fires with kerosene oil. When clothing catches fire, roll the person on the floor, and a blanket or rug quickly thrown around the body will soon subdue the flames.

Burns from Acids. — Wash the part with a strong solution of baking-soda, or spread a thick layer of soap over the part.

Burns from Alkalies. — Wash the part with vinegar diluted with water.

Stroke of Lightning, or an Electric Current. — Expose the body to the cold air, and dash cold water over the chest and abdomen; apply hot bottles to the feet; employ artificial respiration; place a mustard-plaster over the heart, and put ammonia to the nostrils. Whiskey should be given to drink, if the patient can swallow; otherwise inject it into the lower bowel.

BUNIONS are occasioned by narrow-toed boots. *Treatment.* — Wear broad-toed boots, and place a piece of cotton wool between the great toe and the next, to press them apart.

ABSCESSES begin with a hard swelling at one point, and after some days become softer. As soon as an abscess begins to form, poultice it with hot linseed meal, or a hop poultice, and as soon as it becomes soft puncture it with a sharp knife, and press out the pus it contains; afterwards apply a poultice.

Milk Abscess should be treated in the same manner as the above, and the breast should be suspended in a sling. A handkerchief passed around the neck and below the breast, supporting it, will give great relief. Caking of milk in the breast may be removed by rubbing the part with belladonna linament, together with a small dose of Epsom salts.

WHITLOWS. — Whitlows are of two kinds, — first, those where the matter is immediately under the skin; and, second, those where it is under the covering of the bone. They usually occur in ill-health. On the first appearance of a whitlow, half an ounce of Epsom salts should be taken if the bowels are costive. Place the finger in hot water, as hot as it can be borne, for half an hour, and then apply a hot poultice of flaxseed. The arm should be then suspended in a sling passed over the shoulder. If, after this treatment, matter still continues to form, the finger should be lanced. In those whitlows where the matter is formed under the covering of the bone, the finger should be lanced down to the bone as early as possible; for, if this be neglected, the whole bone may be destroyed. After it has been lanced, apply a flaxseed poultice.

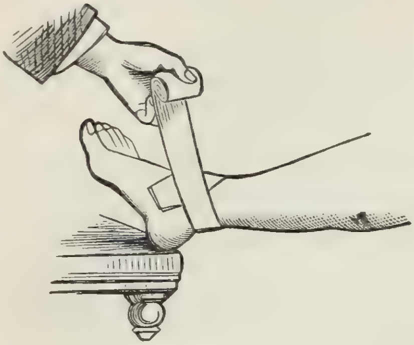
STYE or HORDEOLUM is an inflammation of one of the hair-follicles. A painful swelling forms on the margin of the lid. It may either suppurate, or remain for some time in an indurated or hardened condition, and then gradually subside. It indicates a disordered or enfeebled state of the health. *Treatment.* — Attention to the state of the bowels, carefully regulated diet, and the use of tonics (as iron), comprise the general treatment locally. Warm-water dressings are greatly to be preferred to poultices, which are apt to irritate the skin. The stye should never be rubbed or squeezed; and no incision is necessary, except perhaps a slight puncture through the skin when the pus is pointing. Dilute citrine ointment, applied when first noticed, may prevent the formation of pus; at the same time, tincture of iron should be taken and the bowels kept open.

BANDAGES. — Bandages are used by surgeons for the twofold purpose of applying compression and keeping the part in position. We have an example of the former when a pad and bandage are applied to a bleeding part to arrest the hemorrhage; and of the latter, when a bandage is applied to keep a broken limb in position.

Bandages are generally made of cotton, linen, flannel, rubber, etc., but any kind of cloth may be used. They are generally wound up like a roller, which enables them to be more easily applied. In applying a bandage, care must be taken to have it so adjusted that it will maintain sufficient pressure without unduly interfering with the vitality of the part.

Finger Bandage. — A bandage three quarters of an inch wide will be most convenient, and a couple of turns (leaving out a loose end) should be made round the wrist; the bandage is then brought over the back of the hand, and taken in a series of spiral turns to the tip of the finger which it surrounds, and is brought back by regular spirals in the opposite direction to the root of the finger again, crossing the former bandage on the back of the hand; it finally surrounds the wrist, and can be finished off by making a knot and bow with the loose end.

Leg Bandage should be two and a half inches wide and ten yards long. It should be started around the ankle, as in Fig. 25; it is then carried across the instep and passed under the foot to the inner side and again passed round the ankle, making a figure of eight at each turn. After the foot has been sufficiently bandaged, continue it upwards. When the limb begins to enlarge, "reverses" are made,*—that is, the bandage is folded obliquely downwards, as in Fig. 26; by this means slipping is prevented, and equal pressure preserved. Each turn of the bandage should overlap the previous turn about one third.



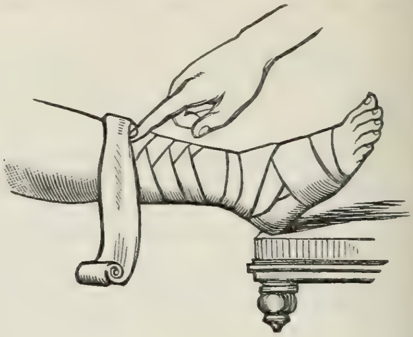
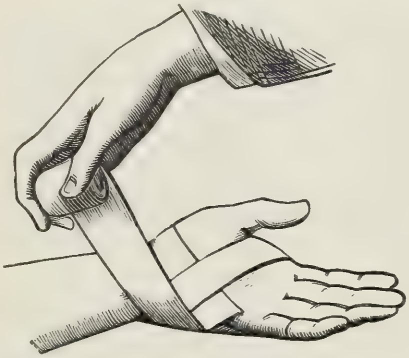


Fig. 25. Leg Bandages. Fig. 26.



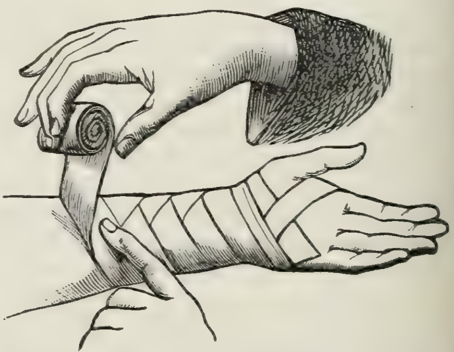


Fig. 27 Arm Bandages. Fig. 28.

Arm Bandages should be half an inch narrower and two yards shorter than a leg bandage. The application is made in the same manner as in the leg; and, when the arm begins to enlarge, reverses are made. (See Figs. 27 and 28.)

Head Bandage.—For an ordinary cut, a piece of leg or arm bandage may be applied, making as many turns as is necessary. When a poultice is to be applied, a four or six tailed bandage is necessary.

Four and six tailed Bandages.—A piece of cloth of sufficient length and breadth is taken and torn up the centre into four or six tails, and the ends tied, as in Figs. 29 and 30. These bandages are also applied to the knee to retain poultices, etc.

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* When flannel or rubber bandages are used, reverses are not necessary.

Groin Bandage. — This useful bandage is best applied while the patient stands, the person applying it being in front of him. Two turns should be made round the thigh of the affected side from within outwards, and fastened by a pin; the bandage is then carried along the lower part of the groin over any pad or poultice desired to be held there; it then passes to the outer part of the pelvis round the back, and over the abdomen and pad to the outer part of the hip, crossing the former fold at the groin, and thus completing the figure of eight. A series of similar turns, each slightly overlapping the other, may be carried round in the same way, until the part is covered and sufficient compression produced.

Many-tailed Bandage. — This may be formed in two ways,— either by taking a piece of calico or muslin the length of the limb, and wide enough to go at least once and a half round it, and then tearing it transversely from each side, in strips two inches wide, to within a couple of inches of the middle; or by making a number of strips of equal length of ordinary bandage, and then attaching them along another central piece at right angles, with a needle and thread. In either case, the central portion is applied to the back of the limb and the transverse pieces folded over it in regular order, beginning from below. In stitching the transverse strips to the central portion, the upper strips should be attached first, and the next made to overlap it slightly, and so on to the end, so that, when folded over from below upwards, each turn may overlap slightly the one below it, and thus give additional support. This is an advantage which the bandage does not possess when made from a single piece of calico.

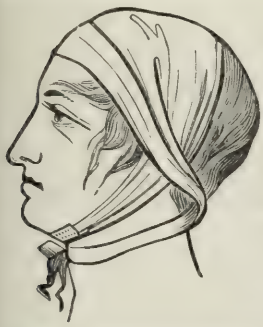
Fig. 29. — Four-tailed Bandage.

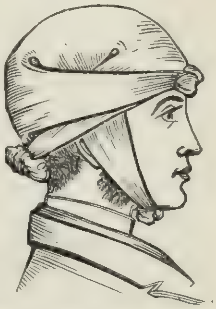
Fig. 30.— Six-tailed Bandage.

The many-tailed bandage is applied to limbs which require constant dressing, but which it is desirable should not be moved, as they would of necessity be for the application of the ordinary roller.

Resuscitation from Drowning. — The body should be removed from the water as quickly as possible, and the mouth cleaned of all substances, as weeds, etc. The executive committee of the Life-saving Society of New York, consisting of Professor Frank Hamilton, Professor C. F. Chandler, and others, have issued the following series of rules for the treatment of persons rescued from the water in an insensible condition:—

Rule I. — To drain off water from the chest and stomach: Instantly strip the patient to the waist. Place him face downwards, the pit of the stomach being raised above the level of the mouth by a large hard roll of clothing placed beneath it. Throw your weight forcibly two or three times, for a moment or two, upon the patient's back, over a roll of clothing, so as to press all fluids in the stomach out of the mouth.

Rule II. — To perform artificial breathing: Quickly turn the patient upon his back, the roll of clothing being so placed beneath as to make the breast-bone the highest point of the body. Kneel beside or astride the patient's hips. Grasp the front part of the chest on either side of the pit of the stomach, resting your fingers along the spaces between the short ribs. Brace your elbows against your sides, and steadily grasping and pressing forward and upward, throwing your whole weight upon your chest, and gradually increasing the pressure while you can count one, two, three. Then suddenly let go with a final push, which springs you back to your first position. Rest erect upon your knees while you can count one, two; then make pressure again as before, repeating the entire motions at first about four or five times a minute, gradually increasing to about ten or twelve times.

Use the same regularity as in blowing bellows, and as is seen in natural breathing, which you are imitating. If another person be present, let him, with one hand, by means of a dry piece of linen, hold the tip of the tongue out of one corner of the mouth, and, with the other hand, grasp both wrists and pin them to the ground above the patient's head.

After-treatment. — After breathing has become natural, dry the patient briskly; wrap him in blankets only, and let him be kept perfectly quiet. Provide free circulation of air. Give brandy and water, — a teaspoonful every five minutes the first half-hour, and afterwards occasionally, as may seem expedient.

GYMNASTICS.

"Gymnastics," in its more common use, is a term applied to those physical exercises performed with the purpose of developing and invigorating the body.

Gymnastic exercises, with more or less system, have been common from the earliest ages, but more especially among the ancients; and of these, the Greeks seem to have been the most thoroughly convinced of the importance of this feature of education, and developed a more complete and scientific system than has ever existed, either before or since. Their gymnasia were well-ordered establishments, combining a great variety of athletic performances, many of which are the favorite pastimes of the present day, — running, jumping, wrestling, boxing, quoit-pitching, top-spinning, etc. Over the various departments of these institutions were placed supervisors of experience,— some whose duty it was to anoint and prepare the performers for the exercise; and others, to study the hygienic effects of the various gymnastics, and assign the beginners to those most suitable for them; and others still, who had in charge the moral welfare of the youth. These are some of the features of the Greek gymnasia, which were so generally distributed over the country that every city or town of any pretension was possessed of one, and held the foremost place in their educational system.

In Athens, only boys and youth were compelled to attend the gymnasia; but the Spartans were more rigid in their gymnastic requirements: girls were also expected to be good gymnasts, and no young woman could be married until she had exhibited her proficiency in gymnastics.

This devotion of the Greeks to physical exercise had a direct influence upon the art of healing. Their philosophers and physicians gave their attention to the study of the relation of gymnastics to the preservation of health; and many maintained that the mind could not possibly be in a healthy state unless the body was likewise in perfect health, and no means were more conducive to preserve or restore bodily health than exercise. And doubtless to this salutary custom of the Greeks was owing that healthy and beautiful development of body by which they excelled all other nations, and also that power and elasticity of mind manifest in all their productions.

But the principal end sought in the practice of gymnastics by the ancients, and also of more modern times, was the development of strong warriors; for, with the methods and instruments of warfare then in vogue, a powerful physique was of more value as a means of obtaining victory than at the present day. Consequently we find that, with the introduction of gunpowder, and through its means the gradual substitution of fighting at a distance, in which science and skill were the main requisites, for personal encounters, where strength and muscle went far to carry the day, the attention to gymnastics decreased, and finally vanished altogether. And it was not until about the commencement of this century that interest in it was revived.

About the year 1806, Basedow and Salzman instituted gymnasia in Prussia, followed by Jahn and others, who rendered the science so popular that it speedily attracted the attention of the youth throughout the kingdom; thence it spread to other kingdoms and countries, and continued to increase in popularity everywhere, until finally it has regained its place as part of the education of youth, and has been assigned a place in the educational systems of Europe and also of this country.

The advantage of gymnastics as a means of developing a vigorous body, and of promoting general health, cannot be questioned. Though, like many other good things, it is liable to abuse, and, by too violent or too long-continued exercising, the body may be injured instead of benefited, yet, with the observance of moderation, none but a good result need be anticipated. The immediate effect of exercise is to stimulate the blood, which, being driven with unusual force throughout the system, increases the activity of all the functions. The digestive organs are thereby greatly aided in the assimilation of food. Further, the muscles thus brought into play increase in size and strength in accordance with an admirable law of nature; the arm assumes a pleasing plumpness; the step becomes more elastic; the whole body, through the accession of muscular strength, is more subject to control, and, in consequence, ease and grace of movement are rendered more possible.

The lungs, too, may be greatly benefited when the exercises are diverted toward the expansion of the chest. In many persons — commonly those whose occupation requires a bending posture — certain parts of the lungs are never brought into action in ordinary breathing; and the air, becoming stagnant in the cells, produces a deterioration in the health of these parts, and they necessarily become vulnerable points for the attack of disease; while, with a little judicious application of gymnastics, they may be made as sound as the rest of the lungs. And it may be added that many of the diseases to which females are peculiarly liable, caused often by weakness of the abdominal muscles, might frequently be relieved, and in many more instances prevented, by the means of a proper physical training.

The end to be sought by the use of gymnastics is the complete development of the muscular system. It is not necessary for an adult to cultivate an excessive hardness of muscle, unless studying for a professional gymnast, and, indeed, the greatest strength is often possessed by muscles that are comparatively soft. This muscular development is attained in a measure by the performance of our daily work: a certain amount of walking and climbing stairs has to be done, which are gymnastic exercises in themselves; but they only actively engage the muscles of the legs and loins, while those of the arms, chest, and stomach have but slight tension. Therefore it is necessary for all — especially those whose occupation is a sedentary one — who desire to acquire and retain a strong body, and the elasticity and vigor of mind in a high degree dependent upon it, to make use of some extraordinary means by which an unequal development of the muscular system may be prevented and general health imparted.

The Dumb-bells. — Of the various technical apparatuses, the dumb-bells are usually considered to hold the first place in the home gymnastics. They have the advantage of requiring but little room either for their exercise or keeping; and also, with them, one who has sufficient ingenuity in movement and position may exercise every joint and muscle in his body. For this purpose they need not be very heavy: from three to six pounds is a sufficient weight for the strongest man; as an hour's practice with a much heavier dumb-bell would be very exhausting. They are made of both wood and iron, but the wooden ones are much preferable for women.

The movements in exercising with the dumb-bells are numerous, and may be greatly increased by the ingenuity of the performer. Some of the principal ones may be given: —

1. Stand erect, heels touching and toes separated, arms falling at the side, hands grasping the dumb-bells with backs outward. Draw the dumb-bells up until they reach the armpits, and let them fall again.

2. Stand as before, raise the arms sidewise slowly, without bending the elbows, until the hands meet over the head. Let them fall in the same way as raised.

3. Bring the dumb-bells up to the chest, shoot them perpendicularly into the air with force, bring them back again.

4. Dumb-bells resting on the chest, shoot the arms horizontally to their full extent; then bring them back forcibly, as if endeavoring to meet the elbows behind the back. This is a good chest exercise.

5. Swing the arms in opposite directions at the sides, like a pendulum, carrying them as far each way as possible.

6. Swing the dumb-bells back, bending the body forward at the same time; then reverse the motion and carry the dumb-bells over the head without bending the elbows, swaying the body, at the same time, backward as far as possible.

7. Let the dumb-bells rest on the chest; turn the body from side to side, keeping the feet fixed.

8. Stand erect, and gradually bend the knees, keeping the body straight, until the dumb-bells touch the floor; rise slowly again.

The *Indian Clubs* are deservedly popular among the lovers of athletic exercises; they furnish an excellent exercise for the muscles of the arms, chest, and shoulders.

The movements of the Indian clubs are more complex, and call for more skill than those of the dumb-bells, but, for that reason, when they have been fully mastered, they give more pleasure in their exercise.

The *Wand* is considered a good developer: for girls, and those possessing little strength, it is one of the best means of physical training.

The *Rubber Apparatus* is also very good, and it has the advantage of being capable of performing the office of several instruments, such as the pulley-weights, health-lifts, and wand, by means of attachment to the wall or floor, or being held in the hands.

Young men, in seeking to develop a strong and healthy body, should take advantage of every means to this end. Variety of exercise should be sought as much as possible, lest the monotony of any certain one should offer temptation to neglect. Walking, riding, rowing, skating, bycycling, are all excellent in their way; and, when feasible, a complete gymnasium should be joined, which not only possesses every variety of apparatus, but, on account of the baths usually attached, will afford a very pleasurable and beneficial ending to the heating exercises.

HYGIENE.

> "Hygiene is the art of preserving health, — that is, of obtaining the most perfect action of body and mind as is consistent with the laws of life; in other words, it aims at rendering growth more perfect, decay less rapid, life more vigorous, death more remote." — *Dr. Parkes.*

The special subjects which hygiene embraces are the following: —

I. Those which concern the surroundings of man, as his habitation, the meteorological condition or climate, etc.

II. Those which concern the personal care of health, such as food, water and other beverages, work and exercise, personal cleanliness, special habits, tobacco, narcotics, etc.

HABITATIONS. — Although we are not always able to select the climate in which we shall live, yet the poorest of us are able to have some choice as to the locality and surroundings of our dwellings. From a given number of houses, we may select that one which has the greatest advantages, and which possesses the fewest defects. For example, we may endeavor to avoid a too crowded locality, surrounded by narrow streets and lanes, where the atmosphere is likely to be impure and vitiated. We may give the preference to a detached or semi-detached house, where we can get as much sunlight and pure air as possible. We can choose between the two sides of a street, so as to obtain the best aspect, say a south or southwesterly one. Above all, we can ascertain if there has been much sickness in the locality, and, if so, give it a wide berth. One of the most important considerations in the selection of a dwelling is, that the drainage shall be perfect. If, upon entering any house, you are greeted with a disagreeable and nauseating stench, you may very readily decide that such a house does not suit you. The foul sewer-gases which escape through ill-constructed, ill-fitting pipes are poisonous in the extreme, and are productive of many malignant diseases. This is a danger which has to be particularly guarded against in large cities.

Pay particular attention to the position of the water-closet. It should never be placed in the centre of a house, where the effluvia can escape into the dwelling apartments, but should be positioned against an external wall, so that it may be lighted and aired from the outside. It is even preferable to have it separated from the body of the house by a passage, if that be possible.

Next in order is the *heating* and *ventilating* of our houses. The overheated, confined, ill-ventilated houses in which Americans dwell is a matter of common remark to foreigners. It is no extraordinary sight to see here, in winter, four or five persons seated in a room heated to 80° and every window tightly closed. *Overheated rooms* are a source of ill-health, and its injurious effects are soon evinced in the faded cheeks and relaxed energy of those who habitually inhabit them. For sitting-rooms, 60° to 65° is sufficient, or at any rate the temperature should never be over 70°. A sleeping-room need never be above 60°, and often, with advantage, below it. Do not sacrifice fresh air to temperature, except in extreme circumstances. There is never any necessity for drafts, if reasonable precautions are taken. A very simple contrivance for admitting air, and at the same time avoiding drafts, is to make a board of the length of the window-sash and six or seven inches wide, and, after pushing up the lower sash, place the board beneath it. There will then be a little space between the upper and lower sashes, through which a current of air will pass upwards without creating any draft.

The paramount necessity of having continual supplies of fresh air may be conceived when we calculate the amount that is consumed with every respiration. "If a man," says Huxley, "be shut up in a close room having the form of a cube seven feet in the side, every particle of air in that room will have passed through his lungs in the twenty-four hours." An adult man breathes about fourteen times in a minute, and in each act of respiration he draws into his lungs about thirty cubic inches of air, and expels a like amount. It is estimated that about four hundred cubic feet are passed through the lungs every twenty-four hours.

Air consists of a mechanical mixture of oxygen and nitrogen, in the proportion of nearly twenty-one per cent of the former to seventy-nine of the latter, with small quantities in addition of carbonic acid, moisture, and organic matter. The carbonic acid should never exceed two parts in 10,000 by volume, and when it does so the atmosphere becomes unwholesome. By respiration and combustion the air becomes vitiated, the oxygen diminishing and carbonic acid and other suspended matter increasing. It is estimated that the amount of impurity given off by a human being under ordinary circumstances is about six cubit feet in ten hours during repose. This will require, in order to retain the proper proportions of air, an hourly supply of 3,000 cubic feet of fresh air.

Enough has been said here to show the necessity of plentiful ventilation; but it may be added that many widely prevalent diseases have been shown to arise from vitiated air, such as consumption, and other forms of scrofulous disorders, bronchitis, pneumonia, sore throat, etc.

The best method of *heating* a house would probably be by the old-fashioned open fireplaces, but that means is not always adequate to our rigorous climate. If the heating is done by a stove, care must be taken that none of the gases escape into the room by means of leaky pipes, etc. The "register" of a stove should never be closed, and in fact it is best not to have any register at all. In heating by furnace, the air is likely to become very dry, unless care is taken to see that the "water-pan" is constantly replenished. It is perhaps well to keep a bowl of water always in the room, as it adds moisture to the air as well as absorbs the carbonic-acid gas.

FOOD.—This subject has been treated separately at another place (see "Household"), and we will only give here a few hints as to its preparation and its relations to work, etc.

We quote a few extracts from the "Family Physician" upon the preparation of food, which are decidedly to the point: "Man is distinguished as a 'cooking animal,' and indeed he is the only animal that does not consume his food raw. It is needless to say that it is absolutely necessary to health and proper nourishment that the food should be properly cooked. *Cooking* is a delicate chemical operation; and, although it is too much the custom to relegate the duties of the kitchen to those who have received hardly any education, it is nevertheless true that those duties demand, of those who *rightly* perform them, patience, education, and very great intelligence."

Dr. Parkes, in his latest work "On the Personal Care of Health," makes the following remarks on the importance of a right understanding of the subject of food, and the method of cooking it:—

"I question whether an artisan or laborer in receipt of pretty good wages, which he does not spend in drink, is not the best-fed man in the community, if he has an industrious wife who knows how to cook. If she be an understanding woman, she will give him enough variety; and he receives every day at the same hours, well distributed over the day, about an equal quantity of well-cooked food, over the eating of which he does not hurry. If such a man be a *teetotaler*, or do not take more than two pints of beer daily, it will be seen that he changes little in weight during the whole period of maturity, and that years tell little on his appearance. If he takes too much beer and spirits, as so many do, he begins to get fat at forty, and then ages.

"Compared with such a temperate workingman, the wealthy classes, as a rule, are, I think, clearly less well off. They have the best description of food and the best possible cooking, but they have neither the regularity of time nor quantity that the sober workingman has."

It is an encouraging symptom of the growing appreciation of the importance of cooking that "schools of cookery" are being established in many of our large cities. "If young ladies would only see that cooking is really a branch of chemistry, and that it is therefore a scientific as well as a most useful art, and if they would get over the ridiculous pride of thinking honest labor a degradation instead of what it really is,—a blessing,—how many of our countrymen would dine well instead of badly, and be robust instead of weakly!"

It is a fallacious idea on the part of some persons that the nearer meat is to a raw condition, the more nutritious it will be. *Meats* should always be thoroughly cooked throughout; and this is especially desirable in pork, which is sometimes infested by a small parasite called *trichina*, and which, if introduced into the stomach in a living state, produces the dangerous and often fatal disease of trichinosis. The trichina is always killed by a boiling temperature, and it is only those who eat raw or underdone pig's flesh that are liable to become infected. The best methods of preparation by cooking are the simplest, such as roasting or boiling.

Roasting is a very favorite way of cooking, as it imparts a pleasant flavor to the meat; but it is not quite as economic a method as boiling, as it loses a large proportion of the weight in dripping. In roasting, we must endeavor to imprison the juices of the meat as much as possible. To effect this, a good clear fire should be made, and for the first fifteen or twenty minutes the joint must be placed as close as possible to it without burning. It must then be removed to some distance, and the process continued as slowly as possible, so as to retain the juices as much as possible.

In *boiling*, we want to attain one of two objects, — either to transfer the virtues of the meat to the *water*, as in broth, or to retain the goodness in the meat without benefiting the water. In making broth, the meat should be cut up in small pieces, and the water be poured upon it *cold*. The vessel should then be placed at the side of the fire, where it should be allowed to remain for some hours, care being taken that the temperature does not rise above 180°, unless just at the last, when the water may be allowed to boil for a minute or two. If these rules be adhered to, and a thermometer be employed, as should always be done, the broth will be the strongest possible.

When a *joint* is boiled *whole* to be served at table, we proceed differently, in order to preserve as much of the juices as possible. To effect this, we plunge the joint at once into *boiling* water, and allow it to remain for a few minutes. By this manœuvre all the albumen on the outside of the joint is coagulated, and the joint is encased, as it were, in a solid coat of armor. This being done, the joint must be left in the water, which should not be allowed to exceed 185° or 190° during the remainder of the process of cooking.

Any intelligent woman who desires to acquire the art of cooking can, by observation and attention, find many simple methods, both in the direction of economy and of rendering the food pleasing to the palate. We would advise housewives to have a thermometer, by which they can regulate the temperature, and thus render the operation more accurate.

The *quantity* of food eaten should be proportioned to the amount of *labor* on the part of the individual. Thus, the food of a *laboring* man should be greater in quantity, and abound more in albuminates, than is requisite for one whose employment is comparatively light. It should not be exclusively of any one class of food, as the tissues of the body require a variety of constituents for their support and nutrition. The result of investigation shows that for a healthy adult man, taking free exercise in the open air, and living upon plain but substantial food, the average quantity required during twenty-four hours is as follows: —

Meat	16 ounces, or	1	pound	avoirdupois.
Bread	19 “ “	1.19	“	“
Butter or fat	3½ “ “	.22	“	“
Water	52 fluid ounces, or	3.38	‘	“

It is well to err rather on the side of moderation than of excess. Too much food causes plethora, and leads to obesity, to a lethargic habit of body, and to a great liability to congestive diseases and gout. The digestive functions are overworked, and, if the food is not digested, it either irritates the intestines, causing diarrhœa, or, if it does not cause diarrhœa, it remains in the intestines, causing pain, and decomposes, giving rise to the generation of offensive gas, or even to worse troubles. It would be well for every one to rise from table feeling capable of eating more, rather than with the stomach overloaded, which dulls both the bodily and mental energies.

WATER.—The water supply merits a special consideration, so important is its relation to health directly as a drink, and indirectly with reference to its other uses. It is required for drinking, cooking, the cleansing of the person, clothing, etc. The hygienic requirements are, that water should be good in quality and sufficient in quantity. Good water should be clear, colorless, quite free from suspended matter, and of a good lustre. Hard water is objectionable for cooking and washing; nor can it be recommended for drinking, although some insist upon a certain amount of hardness being essential. *Hardness* of water is caused by the suspension of lime-salts in it. These salts decompose the soap used in washing, causing it to become flaky, and destroying its cleansing properties. An excessive quantity of lime-salts in water renders it decidedly objectionable, for drinking as well as other purposes; but recent investigations would appear to show that in moderate quantities it is rather desirable than otherwise. The following table has been drawn up, showing the relative hardness of water used in sixty-five English and Scotch towns, and the death rate in those towns:—

HARDNESS.	NUMBER OF TOWNS.	AVERAGE DEATH RATE PER 1,000.
Over 10°...........	25	21.9
10° to 60°..........	17	24.9
6° to 2°.............	15	26.3
2° and under.......	8	28.5

It would appear from these figures, taking all things into consideration, that waters with some degree of hardness are preferable to very soft waters.

Another of the impurities contained in water is *organic* matter, either of a purely *vegetable* origin, or the product of decomposition of *animal* matter. In Boston, during the latter part of 1881, the water supply was rendered very disagreeable for drinking purposes by the presence of a vegetable substance which gave a greenish tint to the water, and made it unpleasant to the palate. This, however, was shown to be entirely harmless as to its effects on the general health. Organic matters produced by the decomposition of vegetable substances are not especially dangerous; but the products of decomposing *animal* substances are highly so, even when in minute quantities. These impurities do not manifest themselves to the taste, and indeed they are frequently considered unusually fine in flavor; nevertheless they contain an active poison. Many of the widely prevalent and most fatal diseases, such as cholera and typhoid fever, have been shown to have been disseminated by the use of waters poisoned with the soakage from soils charged with sewage matters and excrement.

The poisonous effects of bad water have now been demonstrated beyond a peradventure, and most of our large communities have awakened to the necessity of having a pure and unfailing supply of this greatest necessity of life.

The quantity of water per *head* may be stated at a minimum of twelve to sixteen gallons per diem where there is no general system of drainage, and about twenty-five gallons with drainage. In towns, more than this is necessary, and from thirty to fifty gallons are desirable. The best waters are obtained from springs, deep wells, and upland surfaces, where the water is not likely to be contaminated by the influx of sewage.

There are three means resorted to for the purification of contaminated waters,—*filtration*, *distillation*, and *boiling;* but the first-named is the most commonly used. A very simple filter may be extemporized for domestic use by attaching a little flannel bag to the mouth of the faucet, by which a great proportion of the floating particles will be strained off in the passage of the water through it. There are also many little filters, intended to be screwed to the faucets, which answer their purpose very well, and which may be purchased for a trifling sum.

Layers of sand and gravel form very efficient filters, and the water companies employ this means of cleansing the water which they serve out to the public.

A very ingenious filter, called the "Poor Man's Filter," is made by plugging the hole in the bottom of a common flower-pot with a piece of sponge, and then putting in a layer of animal charcoal, another of clear sand, and a third of rather coarse gravel.

There are many means of filtration, from the elaborate tank to the pocket charcoal filter; and the housewife may have her choice of any size or description. It is desirable that water should always be filtered for domestic use, and it is especially advisable during periods of epidemics.

It may be added in conclusion, that water that has remained for any length of time in leaden pipes—say over night—should not be used, as it has been known to produce symptoms of lead-poisoning. The water should be permitted to run for a while until the pipes are emptied, before drawing any for domestic purposes.

The following table shows the relative purity of the waters of many of our large cities:—

CITIES SUPPLIED.	SOURCE OF WATER.	Inorganic Matter.	Organic and Volatile Matter.	•Total Solids.
Boston	Cochituate (E. N. Horsford)	4.12	1.22	5.34
New York	Croton, average for three months in 1868 (C. F. Chandler)	5.66	1.97	7.63
Brooklyn	Ridgewood, " " " " " "	4.51	0.83	5.34
Philadelphia	Fairmount, Schuylkill (E. N. Horsford)	3.95	2.06	6.01
Albany	Hydrant (E. N. Horsford)	14.52	3.96	18.48
Troy	" (W. Elderhorst)	10.44	2.30	12.74
Utica	" (C. F. Chandler)	9.43	1.64	11.07
Chicago	Lake Michigan (J. V. L. Blaney)	9.63	1.81	11.44
Rochester	Genesee River (C. F. Chandler)	20.62	2.12	22.74
Schnectady	State Street well " "	80.38	4.00	84.38
Syracuse	New reservoir " "	20.81	3.08	23.89
Waltham	Charles River (E. N. Horsford)	3.08	1.84	4.92

EXERCISE.—A due amount of exercise, in which all the functions of the body will be brought into play, is necessary in order to maintain a healthy condition. If all the muscles, or those of any particular part, be allowed to remain for a long time unused, they diminish in size, grow softer, and finally become sluggish and debilitated. By use and exercise, on the contrary, the muscles increase in bulk, firmness, and power. It is very important, therefore, that the muscles should be trained and exercised by sufficient daily use. Too much confinement by sedentary occupations, or by simple indulgence in indolent habits, will certainly impair the strength of the body and injuriously affect the health.

Exercise, however, in order to be purely beneficial in its results, must be regular and moderate in degree. Dr. Dalton says: "It will not do for any person to remain inactive during the greater part of the week, and then take an excessive amount of exercise on a single day. An unnatural deficiency of this kind cannot be compensated by an occasional xcess. It is only a uniform and healthy action of the parts which stimulates the muscles, and provides for their nourishment and growth. Exercise which is so violent and long ontinued as to produce exhaustion or unnatural fatigue, is an injury instead of an advanage, and creates a waste and expenditure of the muscular force, instead of its healthy ncrease.

"*Walking* is, therefore, one of the most useful kinds of exercise, since it calls into easy and moderate action nearly all the muscles of the body.

"*Riding* on *horseback* is also exceedingly efficacious, particularly as it is accompanied by a certain amount of excitement and interest, which act as an agreeable and healthy stimulus to the nervous system.

"*Running* and *leaping*, being more violent, should be used more sparingly. For children, the rapid and continuous exercise which they spontaneously take, in their various games and amusements in the open air, is the best.

"The exact quantity of exercise to be taken is not precisely the same for different persons, but should be measured by its effect. It is always beneficial when it has fully employed the muscular powers without producing any sense of excessive fatigue or exhaustion."

Walking, for persons in ordinary health, is a very agreeable and valuable exercise, as well as the most economical one. There is not a more healthful luxury than a ramble through the green fields and meadows of the country on a pleasant summer's day, and it is a luxury that is accessible to every one. The walk, however, should not be a mere saunter, but a good, brisk exercise, with the head erect and the shoulders thrown back and the chest expanded. The mind, as well as the body, will be recreated, strengthened, and purified by the contact with the purity of nature; and the pleasure will be enhanced if we have a congenial companion, with whom we can interchange thoughts and opinions upon what we see.

Swimming is also an excellent and healthful exercise, when done at the right hours and not carried to excess. It involves an equal use of the arms and legs, and, as it is practised in a state of nakedness, the limbs have a freedom of motion which they seldom attain in other modes of exercise. Swimming is not only a healthful exercise, but a knowledge of it is also frequently of vital importance, and we would therefore advise every one to acquire it.

Croquet, *lawn tennis*, *archery*, and other out-of-door pastimes are very useful, and should be encouraged, from a hygienic as well as from a social standpoint.

Bicycling is also good in a moderate degree, but it has the defect of leaving the upper limbs comparatively unexercised.

Dancing is a pastime which should by all means be encouraged, with the condition, however, that its indulgence be moderate and in a pure atmosphere. The rhythmic movements of the dance serve to educate the muscles to a certain extent to a precision of action, and impart a gracefulness of movement. As it is ordinarily carried on, however, in overheated rooms, with the air vitiated and stifling, and indulged in to an immoderate degree, it is the reverse of beneficial; it is, indeed, excessively injurious and harmful.

In discussing the subject of work and exercise, it has been found necessary to adopt a uniform standard expressing the amount of work performed. The *unit* of work employed in England is the effort required to raise tons or pounds one foot in height, tersely expressed as "foot-tons," or "foot-pounds." Upon this scale, it has been calculated that a fair day's work is about three hundred foot-tons. Usually speaking, fifty foot-tons an hour is a fair amount, and this ratio is equal to a walk of three miles for an average man.

The following are some estimates made by Professor Haughton of the actual labor performed in various occupations during an ordinary day's work of eight hours:—

Pile-driving	312	foot-tons.
Porter carrying goods, and returning unladen	325	"
Turning a winch	374	"
Pedlers always loaded	303	"
Pavers at work	352	"
Shot-drill (three hours)	160.7	"
Walking 1 mile on the level, the weight of the man being 150 pounds	17.67	foot-tons.
Walking 10 miles	176.7	"
Walking 1 mile and carrying 60 lbs.	24.75	"
Walking 10 miles and carrying 60 pounds	247.5	"

Persons who are engaged in sedentary occupations ought to take exercise varying from fifty to one hundred foot-tons per diem. This would be equivalent to a walk of from three to six miles on a level road.

Severe exercise immediately after *eating* is injurious, as it interferes with the proper *digestion* of the food; but *light exercise*, such as a short stroll after a meal, is rather helpful to the digestive functions than otherwise. The same rules are applicable both in physical and mental work. The brain should not be heavily taxed immediately after a hearty meal, as doing so leads to indigestion, and to other disorders consequent thereto.

CLOTHING AND PERSONAL CLEANLINESS.—The object of clothing is to protect the body from extremes of heat and cold; preserving warmth in winter, and not too oppressive in hot weather; keeping out wet in wet weather, and yet allowing sufficient transpiration for health. The color of clothing during winter is not important, but during the hot season it should be of some light shade, as it is well known that dark colors absorb the heat, while white and light colors reflect it. White is the comfortable and fashionable color for clothing in summer. It reflects heat well, and prevents the sun's rays from passing through and heating the body. The texture of clothing should be porous, so as to give ready escape to the perspiration, and a free admission of air to the skin. For this reason woollens, which excel in that quality, should be worn constantly.

The most healthful underclothing for all the year round is that made of wool, especially in our climate, which is subject to sudden variations of temperature. The body should be completely covered with woollen undervests, drawers, and socks.

Clothing should allow absolute freedom of movement to every part of the body. It ought never to be tight around the waist, neck, and arms, or across the chest. Every one should be able always to draw the fullest breath possible without feeling any restraint imposed either across the chest or around the waist. So much has been preached and spoken against the custom of tight lacing, that those women who still retain the absurd practice may be regarded as hopeless cases of imbecility. Perhaps the only argument that can reach them is, to convince them that "wasp waists" are a deformity and not an ornament. The use of stays and tight waistbands, indeed, ought to be entirely discontinued, except in the case of disease; and the necessity for any of these supports may be accepted as the proof of an unhealthy condition. If a woman is healthy, she cannot continue so long, if she persists in restraining the movements of the chest and abdomen with an apparatus of stout jean and whalebone.

Coats should never be tight across the chest. The best form of coat for a man is the open "sack coat," and, next to this, the so-called "evening coat," which permits great freedom of movement.

Boots must be easy, and allow absolute freedom to the foot, and they should be stout enough to resist a moderate amount of wet. It is better to wear a stout boot than to trust to rubbers or overshoes, which keep the feet very cold. The heel of a boot ought not to be too high, as in that case the weight of the body is thrown upon the toes, crippling the action, and producing deformity of the foot.

The feet should be warmly clothed, both in summer and winter, and the socks or stockings should be changed frequently. We quote a few words from the *Scientific American* upon this subject, which are to the point:—

"Many are careless in the keeping of the feet. If they wash them once a week, they think they are doing well. They do not consider that the largest pores of the system are located in the bottom of the foot, and that the most offensive matter is discharged through the pores They wear stockings from the beginning to the end of the week without change, which become completely saturated with offensive matter. Ill health is generated by such treatment of the feet. The pores are not repellents, but absorbents, and this fetid matter, to a greater or less extent, is taken back into the system. The feet should be washed every day with pure water only, as well as the armpits, from which an offensive odor is also emitted unless daily ablution is practised. Stockings should not be worn more than a day or two at a time. They may be worn one day, and then aired and sunned and worn another day, if necessary."

This leads us to a consideration of cleanliness in clothing. Filth is one of the prime factors in the production and propagation of most of the devastating plagues known to mankind, and the uncleanliness of clothing is the chief cause of uncleanliness of the body. It may be remarked that, amongst the poorer classes in this country, the underclothing is seldom changed with sufficient frequency. We cannot dwell with too much emphasis upon the importance of frequently changing and cleansing the clothing that is worn next to the skin. Sweat readily decomposes and very soon becomes offensive; and clothing saturated with sweat, if not washed, becomes unwholesome to the wearer and offensive to others.

It is advisable for every one to take a daily general bath; but, if that is not possible, the body should be subjected, at least once a week, to a thorough and conscientious *scrubbing*. To be poor is no disgrace, but to be unclean is a shame and a crime. If we allow the skin to become filthy, its proper action will be interfered with, thereby affecting the whole system and often causing dangerous disease. Especially are many skin diseases directly attributable to uncleanliness, and all skin diseases are greatly aggravated by it.

A bath should never be taken on a full stomach, or during the first stages of digestion. By general consent, the early morning is chosen as the best time for a bath, but an evening bath may be used with advantage, as it tranquillizes the mind and causes the sleep to be sound and refreshing. The temperature of the bath must be decided principally by the sensations of the person. A cold bath is tonic and stimulating to the system, but it must be used with caution, and it should not be persisted in when the weather is severely cold. For persons of delicate constitution, a tepid bath is the best; but hot baths are weakening and debilitating to the system, and should not be indulged in oftener than once a week.

Sea-baths, owing to the salt dissolved in the sea, are more stimulating than simple cold baths. The sea is of a more equable temperature than river water, and is generally warmer. The bather, moreover, has the benefit of the sea air, which is an additional advantage. Salt water, however, is more exhaustive to the system than fresh, and the bather must be exceedingly careful not to remain too long in the water. A recent writer says in regard to the duration of sea baths: —

" On this head much ignorance prevails, and much damage to health and needless delays in the cure of disease are caused by such ignorance. Very many persons, especially of the younger class, stay in the water until they are tired, and are often surprised that they should pay the tax for their rashness in subsequent suffering from some one or more of the following disorders; namely, defective reaction, as shown by paleness of the skin, blueness of the lips, sleeplessness, loss of appetite, rheumatic pains, headache, bronchitis in those with a delicate chest, ear-ache, fulness of the head, giddiness, and various spasmodic affections. From the same cause arises disturbed digestion, manifested by pains in the stomach, nausea, and diarrhœa."

The time which it is safe to remain cannot be exactly stated, but must depend upon the strength of the bather and the temperature of the water. It may vary from a single immersion, or dip, to a bath of a quarter of an hour's duration. A positive indication that the bath has been sufficiently prolonged is the first appearance of blueness about the lips and tips of the fingers, due to the retardation of the blood in the vessels, but no one should wait until these symptoms are well developed before deciding that it is time to withdraw.

We subjoin a summary of directions to bathers, which have been condensed from an admirable work by Dr. Trall: —

1. Never bathe immediately after eating.
2. A full bath should not be taken in less than three hours after a full meal.
3. Do not take a cold bath when in a state of chilliness or fatigue.
4. Always have the feet comfortably warmed by fire, hot water, or exercise, at the time of taking any cold bath.
5. If inclined to headache, wet the head with cold water before bathing.
6. Do not eat soon after bathing; an hour should elapse after a full bath, and half an hour after a local bath, before taking the meal.
7. Patients should exercise before and after bathing.
8. After bathing do not sit in a draught of cold air, nor allow the feet to become cold.
9. Avoid all very cold or very hot baths in all cases of great debility, local congestions, or determinations of blood to particular parts; also all processes which disturb the circulation, as shower, douche, and plunge baths.
10. All full baths, except the warm, are better in the morning or forenoon than in the afternoon or evening.
11. When baths are taken regularly every day, they should be omitted occasionally, as one day in a week, or two or three days in a month.
12. Patients should never take a bath so cold that fatiguing exercise is necessary to "get up reaction." The better way is to use water of a milder temperature.
13. Very feeble persons should have the water for all bathing purposes at nearly the neutral temperature, which is 90°, varying but a few degrees above or below.
14. The temperature of the bathing-room should always be comfortably warm and well ventilated. For invalids the temperature should be 70° to 80°.

In the foregoing observations we have endeavored to offer some suggestions as to the personal care of health, but the subject of hygiene itself is so extensive in its range that it can only be cursorily treated within the limitations of our space. These suggestions must, moreover, be supplemented by the attention and practical good sense of each person for himself, with due regard to his own individual characteristics. If we find that any articles of diet, or any particular mode of conduct, affect us injuriously, it will be wise to abstain from such articles, or to modify our manner of life according to the dictates of reason. It is not necessary to make "life a burden," as we have heard some complain, by denying ourselves every trifling gratification; but merely to guide our conduct by the monitions of our judgment, so that we may attain "the most perfect action of body and mind as is consistent with the laws of life." Riches, power, or social preëminence are not essential to happiness; but good health is certainly one of the requisites of the perfect enjoyment of life and its activities. It therefore behooves every one, in so far as it is within our own power, to retain and cultivate a perfect physique. In addition to this, it may be said that it is a solemn *duty* imposed upon every conscious soul to transmit to his offspring an unimpaired vitality, that the child shall not be handicapped in its career of life by the legacy of a diseased and debilitated physical system. "The sins of the father shall be visited upon the children even unto the third and fourth generations," is one of the laws of God that is inscribed, not only upon the pages of Scripture, but with terrible distinctness upon the living generations themselves. Although this does not properly pertain to the *personal* care of health, yet it is one of the *incentives* to the proper regulation of our conduct.

For spirituous beverages, see "Alcohol." See also "Tea," "Coffee," "Tobacco," "Opium."

VITAL STATISTICS.—Mental labor is not incompatible with longevity. The following is a short list of some of the most energetic in mental work:—

Adams, John Quincy	81 years.
Bacon, Lord	78 "
Franklin, Benjamin	84 "
Herschel, Sir John	84 "
Voltaire	85 years.
Newton, Sir Isaac	85 "
Carlyle, Thomas	86 "

Average Longevity of Divers Avocations.—The following was reported by Dr. Jarvis, being a table of the average longevity in some of the leading occupations in the States of New York, Massachusetts, and Rhode Island:—

Occupations.	Deaths.	Average Age.
Clergymen	389	55.36
Lawyers	576	54.26
Physicians	540	54.32
Blacksmiths	822	51.51
Carpenters	2,052	49.72
Masons	492	48.29
Merchants and clerks	2,386	47.46
Tanners	230	47.90
Cabinet-makers	253	46.34
Shoemakers	3,233	43.03
Painters	500	43.37
Tailors	486	41.08

Births.—In countries where birth records are kept, the annual number of births to each 1,000 of the population varies, and is more in rural districts than in cities.

Fewer births occur in cold than in warmer climates. More boys are born in Europe than girls, the mean proportion being 106 boys to 100 girls. A greater number of children are born during the first three months of the year; and the greatest number in proportion between midnight and 6 A. M.

Marriage is favorable to longevity. Married men from 25 to 30 years of age die at the rate of 6, unmarried at the rate of 10, and widowers at the rate of 22, per 1,000 per annum. Maids from 30 to 35 years of age die at the rate of 11, and married women at the rate of 9, per 1,000 per annum.

Deaths.—The greatest number of deaths occur during the last three months of the year, and between the hours of midnight and 6 A. M.

The greatest number of deaths occur in children under five years of age.

Expectancy of Life.—Insurance companies are aware of the uncertainty in duration of those lives they assure, and have therefore compiled numerous tables of expectancy of life. These tables have been the result of careful calculation, and seldom prove misleading. Of course sudden and premature deaths, as well as lives unusually extended, occasionally occur; but the average expectancy of life of an ordinary man or woman is as follows: A person 1 year old may expect to live 39 years longer; of 10 years, 51; of 20 years, 41; of 30 years, 34; of 40 years, 28; of 50 years, 21; of 60 years, 14; of 70 years, 9; of 80 years, 4.

Vital Statistics of Cities, compiled by the National Board of Health, for the Year 1880.—The death rate shows the number of deaths to each 1,000 persons during the year:—

City.	Population.	Death Rate per 1,000.
Chicago	503,298	17.9
Philadelphia	850,000	18.3
St. Louis	383,577	18.8
Boston	375,000	20.
Baltimore	393,796	20.9
London	3,254,260	21.
Leeds	318,921	21.8
Glasgow	589,598	21.9
New York	1,203,223	23.4
Paris	1,988,806	24.
Brooklyn	556,889	25.8
New Orleans	216,359	27.7
Lyons	342,815	27.7
Berlin	1,096,644	29.3
Dublin	314,666	32.9

FOOD may be briefly stated to be anything which promotes growth or nourishes the body. Before entering into the varieties of food, we will speak of its action in *sustaining* life.

"A bundle of muscle-fibres is a kind of machine, consisting of albuminous material, just as a steam-engine is made up of steel, iron, brass, etc. Now, as in the steam-engine, coal is burned in order to produce force; so in the muscles, fats or hydrocarbons are burned for the same purpose. And in the same manner as the constructive material of the steam-engine (iron, etc.) is worn away and oxidized, the constructive material of the muscle is worn away; and this wearing away is the source of the nitrogenous constituents of the urine.

"This theory explains why, during muscular exertion, the excretion of nitrogenous constituents of the urine is little or not at all increased, while that of carbonic acid (from the lungs) is enormously augmented: for, in a steam-engine moderately fired and ready for use, the oxidation of iron, etc., would go on tolerably equably, and would not be much increased by the more rapid firing necessary for working; but much more coal would be burned when it was at work than when it was standing idle."

It is easy to see, therefore, if either of the repairing or heat-producing elements be absent from food, there must result either a wearing away of the tissue without repair, or a loss of power, to keep the machine in motion.

Physiologists have divided food into two classes,—first, those containing elements for repairs of the tissue; second, those that produce heat.

The first class are called nitrogenous, being made up of the elements carbon, nitrogen, hydrogen, and oxygen; the second class contains only carbon, hydrogen, and oxygen, and are called the non-nitrogenous. Both of these are present in the animal and vegetable kingdoms. Besides these, phosphates and other salts are present, and assist principally in the maintenance of brain and nervous tissue.

Water has no active properties, but only by its presence moistens the tissues, reduces solids to liquids, so that they may be easily carried from one part to another; it also regulates the temperature of the body, etc.

The following is a table of the most important articles of diet, in their *natural state*, showing their comparative usefulness as flesh-repairing or heat-giving (for their digestibility, see "Digestion"): —

ARTICLES.	Nitrates, or Materials for Muscles.	Heaters or Carbonates.	Food for the Brain and Nervous System.	Water.	Waste.
Wheat	14.6	66.4	1.6	14.0	3.4
Barley	12.8	52.1	4.2	14.0	16.9
Oats	17.0	50.8	3.0	13.6	16.9
Northern corn or maize	12.3	67.5	1.1	14.0	5.1
Southern corn	34.6	39.2	4.1	14.0	8.1
Buckwheat	8.6	53.0	1.8	14.2	22.4
Rye	6.5	75.2	0.5	13.5	4.3
Beans	24.0	40.0	3.5	14.8	17.7
Peas	23.4	41.0	2.5	14.1	19.0
Lentils	26.0	39.0	1.5	14.0	19.5
Rice	5.1	82.0	0.5	9.0	3.4
Potatoes	1.4	15.8	0.9	74.8	7.1
Sweet potatoes	1.5	21.8	2.9	67.5	6.3
Parsnips	2.1	14.5	1.0	79.4	3.0
Turnips	1.2	4.0	0.5	90.4	3.9
Carrots	1.1	12.2	1.0	82.5	3.2
Cabbage	1.2	6.2	0.8	91.3	0.5

ARTICLES.	Nitrates, or Materials for Muscles.	Heaters or Carbonates.	Food for the Brain and Nervous System.	Water.	Waste.
Cauliflower	3.6	4.6	1.0	90.0	0.8
Cucumbers	0.1	1.7	0.5	97.1	0.6
Milk of cow	5.0	8.0	1.0	86.0	
Human milk	3.0	7.0	0.5	89.5	
Veal	17.7	14.3	2.3	65.7	
Beef	19.0	14.0	2.0	65.0	
Lamb	19.6	14.3	2.2	63.9	
Mutton	21.0	14.0	2.0	63.0	
Pork	17.5	16.0	2.2	64.3	
Chicken	21.6	1.9	2.8	73.7	
Codfish	16.5	1.0	2.5	80.0	
Haddock	14.0	0.6	2.6	82.8	
Sole	17.0	0.8	2.5	79.7	
Plaice	14.0	very little	5 or 6	80.0	
Flounder	15.0	some fat	3 or 4	78.0	
Turbot	14.0	very little	5 or 6	79.0	
Trout	16.9	0.8	4.3	78.0	
Whiting	15.0	very little	5 or 6	78.0	
Smelt	17.0	very little	5 or 6	75.0	
Salmon	20.0	some fat	6 or 7	74.0	
Eels	17.0	some fat	3 or 4	75.0	
Herring	18.0	some fat	4 or 5	75.0	
Halibut	18.0	some fat	3 or 4	74.0	
Oysters	12.6		0.2	87.2	
Clam	12.0	very little	2 or 3		
Lobster	14.0	very little	5 or 6	79.0	
Eggs, white of	13.0		2.8	84.2	
Eggs, yolk of	16.9	29.8	2.0	51.3	
Butter		100.0			
Artichoke	1.9	19.0	1.8	76.6	0.7
Asparagus	0.6	5.4	0.4	93.6	
Bacon	8.4	62.5	0.5	28.6	
Carp	18.0	0.8	2.9	78.3	
Cheese	30.8	28.0	4.7	36.5	
Cherries	0.6	21.0	1.0	76.3	1.1
Chocolate	8.8	88.0	1.8		1.4
Cream	3.5	4.5		92.0	
Currants	0.9	6.8	0.3	81.3	10.7
Dates, fresh		73.7		24.0	2.3
Figs	5.0	57.9	3.4	18.7	15.0
Greengages	0.3	26.8		71.1	1.8
Ham	35.0	32.0	4.4	28.6	
Horseradish	0.1	4.8	1.0	78.2	16.0
Kidney	21.2	0.9	1.4	76.5	
Lard		100.0			
Liver	26.3	3.9	1.2	68.6	
Onions	0.5	5.2	0.5	93.8	
Pearl barley	4.7	78.0	0.2	9.5	7.6
Pears	0.1	9.6		86.4	3.9
Pigeon	23.0	1.9	2.7	72.4	
Prunes	3.9	78.6	4.5	13.0	
Radishes	1.2	7.4	1.0	89.1	1.3
Suet		100.0			
Venison	20.4	8.0	2.8	68.8	
Vermicelli	47.5	38.0	1.7	12.8	
Whey		4.6	0.7	94.7	

It is easy to see, from the above table, that many of the articles of diet contain an excess of heat-producing elements, and *vice versa.* From these facts it will be plain that a mixed diet is the best and most economical food for man.

From experiments it has been found that the quantity of *carbon* daily lost from the body amounts to about 4,500 grains, and 300 grains of *nitrogen;* and therefore, if a man could be fed on these elements alone (viz., carbon and nitrogen), the problem of nutrition would be a simple one. But animals can only live on these elements when they are arranged in a particular manner with others, in the form of organic compounds, as albumen, starch, fat, and the like.

For example, if a man's diet were confined to bread, he would eat therefore, in order to attain the requisite quantity of *nitrogen*, twice as much *carbon* as was necessary, for bread contains thirty per cent of carbon and one per cent of nitrogen. He would have to consume 30,000 grains of bread, containing 9,000 grains of carbon, in order to obtain 300 grains of nitrogen, and the excess of carbon above the amount required would be 4,500 grains.

Again, supposing he lived on *meat* alone, he would have to take 45,000 grains of meat, containing 1,350 grains of nitrogen, to get the necessary amount of carbon; and the nitrogen, therefore, would be largely in excess.

Dr. Dalton believed, from some experiments which he performed, that the quantity of food daily necessary for a healthy man taking free exercise in the open air is as follows:—

Meat, 16 ounces; bread, 19 ounces; butter or fat, 3½ ounces; water, 52 fluid ounces.

The quantity of meat is probably in a greater proportion than is needed in most individuals under ordinary circumstances.

When an excess of nitrogenous food is taken, only the amount required is retained, the greatest bulk of it passing off through the kidneys as urea; a small portion, no doubt, only being converted into fat.

When an excess of non-nitrogenous food is eaten, the excess is deposited in the tissues in the form of fat, giving rise to "fleshiness." In those who live an active life, a larger amount of *non-nitrogenous* diet is needed; but not so of the *nitrogenous:* whether active or not, the same quantity of the latter is required.

Having spoken of the results of healthy food, we will mention some foods that are injurious, but most of these are mentioned in Household Department. (See article on "Household.")

Unwholesome Food.—Meat cannot be subjected, like many elementary articles, to adulterations, but it may be in an unwholesome condition.

Good meat has the following characteristics:—

1. It is neither of a pale-pink color, nor of a deep-purple tint (for the former is a sign of disease, and the latter indicates that the animal has not been slaughtered, but has died with the blood in it, or has suffered from acute fever), but of a bright, clear color.
2. It has a marbled appearance, from the ramifications of little veins of fat among the muscles.
3. It should be firm and elastic to the touch, and should scarcely moisten the fingers; bad meat being wet, sodden, and flabby, with the fat looking like jelly, or wet parchment.
4. It should have little or no odor, and the odor should not be disagreeable.
5. It should not shrink or waste much in cooking.
6. It should not run to water, or become very wet, on standing for a day or so, but should, on the contrary, be dry upon the surface.
7. When dried at a temperature of 212°, it should not lose more than seventy to seventy-four per cent of its weight, whereas bad meat will often lose as much as eighty per cent. To this may be added that there should be no sign of parasites in the meat. The quantity of fat also should neither be excessive nor deficient.

Unwholesomeness of food arising from the condition of the animal previous to death are,—1st. The existence of parasites; 2d. Infectious diseases; and 3d. Contamination by some drug or noxious agent consumed during life.

I. *Parasitical Diseases.*—Measly pork contains the germs of tapeworm. Trichinæ (usually contained in pork, but sometimes in other meats) is the cause of much suffering, and frequently of death, in those that have eaten it. (See "Trichinosis.")

II. Various kinds of diseases of an acute, infectious nature, such particularly as rinderpest, anthrax, or malignant pustule, and pleuro-pneumonia, are sometimes poisonous to the human system.

Looking at the evidence in regard to the effects of consuming meat derived from animals which have been subject to infectious diseases, it may be said that, although some of the poisonous conditions may become neutralized or destroyed in the process of cooking and digestion, yet, considering the danger of serious consequences ensuing, it is safest to regard all such diseased meats as unfit for food.

Decomposed Meats.—The injurious effects of decomposition are sometimes neutralized by cooking; but it is apt to cause diarrhœa and vomiting, and therefore such meats should never be used.

Poultry, Game, and Wild Fowl.—Next to the mammals, birds are the most important to us in an alimentary point of view. They are, as a rule, free from disease.

Fish is an important article of nourishment. The only ill effect is, in regard to its poisonous nature when it has fed from copper tanks, or is decomposed.

Milk is sometimes unwholesome from being obtained from animals suffering from disease.

Vegetable Products.—Wheat is sometimes attacked by a little insect called the weevil; but it cannot be said that any harm is produced by these animals, except in deteriorating its commercial value.

Bread is often adulterated, and large quantities of alum are sometimes used to whiten it. Bread, when kept in a moist atmosphere, is subject to a fungous growth or mould, which is apt to be injurious when eaten.

Rye is subject to a parasitic fungus, which gives to the grains deleterious properties. All cereals are subject to this, but especially rye.

Fruits.—Fruit, when in its season and used in moderate quantities, is healthful; but canned fruits are sometimes rendered injurious by the action of the acids in the fruit upon the tin cans. Preserved peas and pickled articles are often artificially colored with Paris green, and are thus rendered poisonous.

In the preparation of all vegetables and fruits containing acids, great care should be observed in the selection of vessels to be used, as, by the action of these acids on copper, verdigris, or subacetate of copper, is formed, which is an extremely poisonous substance.

ALCOHOL.—Alcohol is the result of the fermentation of grape-sugar, or substances convertible into grape-sugar. All substances containing starchy matter (such as rye, corn, potatoes, etc.) are easily converted into grape-sugar by treating them with sulphuric acid. The conversion thence into alcohol is effected by the combination, with the sugar, of water or watery vapor and a *ferment.* This latter is supposed to be always present in the air in the shape of small particles or germs, which fall into the fermentable liquors, setting up a chemical action which has, for its result, alcohol.

Pure alcohol, or *absolute alcohol* as it is called, is a rare article; but, in its diluted forms of spirits of wine and other liquors, it is familiar to all. Alcoholic beverages contain but a small percentage relatively of "absolute alcohol," and their peculiar flavors are due to the extractive matters, free acids, etc., contained in the substances from which they were distilled.

The percentage of alcohol contained in various ordinary liquors is as follows: —

Ginger beer	a trace	Rhone wine	9 to 13 per cent.
Beer (average sample)	5 per cent.	Burgundy wines (red)	7 to 14 " "
London porter	5 to 6 " "	" " (white)	9 to 12 " "
Edinburgh ale	5 to 6 " "	Champagnes	5 to 13 " "
Port wine	15 to 17 " "	Moselles	8 to 13 " "
Sherry	14 to 16 " "	Rhine wines	8 to 16 " "
Madeira	14 to 16 " "	Italian wines	14 to 19 " "
Dry Lisbon	16 " "	Brandy	50 to 60 " "
Marsala	15 to 25 " "	Gin	49 to 90 " "
Bordeaux (red wines)	6 to 13 " "	Whiskey	50 to 60 " "
" (white wines)	11 to 18 " "	Rum	60 to 77 " "
Rousillon	11 to 16 " "		

The above percentages are based upon the analysis of unadulterated liquors, but adulterations are very frequent amongst the venders of alcoholic beverages; and foreign ingredients are sometimes added to improve their flavor, or increase their intoxicating effects. The following is a list of deleterious articles said to be sometimes added to beer: Cocculus indicus, copperas, opium, Indian hemp, strychnine, tobacco, darnel-seed, logwood, salts of lead and zinc, alum, etc.

Besides the above-mentioned liquors, there are those of domestic make, such as cider, perry, blackberry, and other wines. The amount of alcohol varies in these from seven to ten per cent.

The Effects of Alcohol in Health.—Alcoholic liquors, when first swallowed, impart a pleasing sensation of warmth to the body, stimulating the action of the heart, and thus producing a more rapid circulation of the blood; the intellect becomes more active, the cheeks flushed, and the eyes sparkling; also the physical force and heat are temporarily increased. However, a reaction soon takes place: the animal heat diminishes, the muscles become relaxed, the brain grows cloudy and inert; and, finally, a profound stupor supervenes, if the liquor has been drunk in excess. We will give here a brief outline of the effects of alcohol upon the various organs of the body: —

1. *Upon the Stomach and Digestion.* — It increases the flow of the gastric juice, but at the same time coagulates albuminous substances, thus retarding their digestion. By its continual use, the stomach becomes indurated, and eventually passes into a condition of chronic inflammation, which induces dyspepsia.

2. *On the Brain.* — Alcohol has a more immediate and palpable influence on the brain than upon any of the other organs. By its habitual use, the healthy condition of the brain is disordered; its tissues lose their moisture, and become dried and hardened. This condition disturbs the normal operations of the brain, and ultimately tends to produce various mental and nervous disorders, such as paralysis, epilepsy, insanity, etc. Its effect also on the nervous system is very apparent in the "paralysis agitans," the trembling of the limbs, as seen in the habitual drunkard.

3. *On the Muscular System.* — Another of the effects of the habitual use of alcohol on the system is in causing a fatty degeneration of the muscles, and especially of the heart. The action of the heart is weakened, and the blood is propelled with less energy through its vessels; the smaller blood-vessels become congested and dilated, as we see in the reddened nose and bloodshot eyes of the drunkard.

4. *On the Excretory Organs.*—The liver is the most exposed to the action of alcohol, on account of the alcohol being collected by the vessels that surround the stomach and conveyed to the liver, which organ it passes through before entering into the general circulation.

The liver either suffers from fatty degeneration, or from slight attacks of inflammation, which ultimately produce the condition known as scirrhosis of the liver. The kidneys also, in their endeavors to eliminate the alcohol, are overworked, producing eventually diseases which are classed under the head of Bright's diseases.

The above is a brief outline of the effects of the habitual use of alcoholic drinks on the different organs of the body. Its influence on the human being as a whole is too painfully evident to need much comment: the intellect becomes shattered, the will becomes wavering and impotent, the moral qualities and the sense of duty grow feebler and feebler; and finally, an early and painful death is the consummation of the moral and mental wreck.

The following is a table of the average "expectation of life" in temperate and intemperate persons respectively, showing the relative loss of life caused by alcoholic indulgence:—

AGES.	TEMPERATE.	INTEMPERATE.	LOSS OF LIFE.
20 years.	44 years.	15 years.	29 years.
30 "	36 "	14 "	22 "
40 "	29 "	12 "	17 "
50 "	21 "	11 "	10 "
60 "	14 "	9 "	5 "

It has also been ascertained by investigators of the subject, that the average duration of life, after beginning the use of alcoholic beverages, is, among beer-drinkers, 21.7 years; among spirit-drinkers, 16.7 years; and among those who drink spirits indiscriminately, 16.1. It is very evident from these statistics that the duration of life is materially diminished by alcoholic indulgence: although in some exceptional cases the intemperate live to an old age, yet they bear a very small proportion to the bulk of those whose lives are shortened by intemperance.

Hereditary Alcoholic Intemperance.—It is unquestioned now among scientists that intemperance is hereditary, and that it is the source of various forms of insanity. Dr. Macleod (Professor of Surgery in the University of Glasgow) says, concerning the question of inheriting a taste for alcohol: "We perceive, in dealing with children of intemperate persons, their ailments, mental and corporeal, not unfrequently take a complexion of their own from the habits of the parents. The low vitality, the stunted growth, the late maturity, the epileptic seizures, the hydrocephalus and numerous other morbid conditions met with occasionally, own the intemperance of the progenitor as their cause." Dr. Darwin also says, in confirmation of this view: "It is remarkable that all the diseases that spring from drinking spirituous and fermented liquors are likely to become hereditary, even to the third generation, gradually increasing, if the cause be continued, until the cause becomes extinct."

Use of Alcohol as a Medicine.—After having stated the ill effects of alcohol in health, we cannot but in justice also mention the beneficial results of it as a medicine. In low fevers, such as typhoid, when the tongue becomes dry, the pulse fluttering, and the mind wandering, the benefits of alcoholic stimulants are admitted by even those most opposed to their use: the pulse becomes stronger, the tongue moist, and the general condition improves when it is administered. There is nothing actually nutritious in alcohol, and its effects are purely stimulating; and it is with this object it is given, to sustain the heart's action by small and oft-repeated doses, until the violence of the fever has abated, and nature is enabled to sustain herself. Also in those chronic diseases, such as consumption, it has the power of retarding the too rapid breaking-down of the lung-tissue; not that it in any way prevents the disease, or has any directly curative effect itself, but, purely as a preservative, it assists in prolonging the life.

The various disorders arising from intemperance, such as *delirium tremens*, etc., will be treated under the head of "Diseases."

Rules for the Use of Stimulants in Fevers.

1. If, after stimulants, the tongue becomes dry and baked, they are doing harm; if the tongue becomes moist, they are doing good.
2. If the pulse becomes quicker, they are doing harm; if it becomes slower, they are doing good.
3. If the skin becomes hot and parched, they are doing harm: if it becomes more comfortably moist, they are doing good.
4. If the breathing becomes more hurried, they are doing harm; if it becomes more tranquil, they are doing good.
5. If sleep is produced and delirium quieted, they are doing good.

COFFEE is the product of a tree called the *coffea arabica*, which grows in Arabia, the East and West Indies, South America, and other warm countries. Several constituents enter into the composition of coffee; viz., cafeine, which is its active principle: gum, sugar, tannin, fatty and volatile oils.

Coffee as a beverage has a stimulating and refreshing effect; but it is a fallacy to suppose that it assists digestion, as the tannin it contains causes the contraction of the blood-vessels, diminishing the flow of the gastric juices, and thus having a tendency to produce *dyspepsia*. It also conduces to *constipation*. The most valuable properties of coffee are its invigorating and restorative effects on the system, and also in its power of relieving the sensations of hunger and fatigue. It arouses the mental faculties and the energies generally, and so disposes to wakefulness, but in this latter respect its influence is inferior to tea.

The excessive use of coffee is apt to produce nervous irritation, manifested sometimes in the twitchings of the muscles of the face, and also in palpitation of the heart.

Coffee is used medicinally in cases of opium-poisoning and *delirium tremens*, its stimulating influence sustaining the action of the heart. Ground coffee is usually adulterated with certain non-injurious articles, such as chicory, peas, beans, etc.

TEA is the product of several different species of the plant called *thea*, and is imported from China and Japan. The different varieties depend upon the mode of drying. Green teas are supposed to be the most injurious, as they are often artificially colored. The purest tea in the market is the uncolored Japan.

Besides the tea proper, it is a common practice to mix odoriferous plants with it in order to improve its odor. In composition it is somewhat similar to coffee, its active principle being called *theine*.

Concerning the general differences between tea and coffee, it may be said that tea is yet more stimulating and refreshing than coffee in states of fatigue of brain and muscle. Also, when taken in excess (especially chronic excess), it more powerfully affects the nervous system, causing trembling of the hand, etc., than the excess in coffee. On the other hand, coffee is more prone to produce dyspepsia and distressing palpitations of the heart than tea.

In its medicinal uses, tea is very similar to coffee.

OPIUM is the inspissated juice of the *papaver somniferum*, or poppy, which is principally grown in Persia, Egypt, Asia Minor, and India. The poppy also grows in England and in this country, but it is a coarser variety of the Oriental plant, and is inferior in its medicinal qualities. The process of obtaining the drug is by making incisions in the unripe capsule, and collecting the juice which exudes. The white milky juice is allowed to dry in tears on the plant, and is then scraped off and pressed into a compact mass, after which it is dried in a warm, airy room.

Opium is, without exception, the most valuable drug in the *materia medica* for allaying pain and producing sleep. When taken in small doses, it acts as a stimulant; but in larger doses the stimulating effect soon passes off, and is followed by languor and drowsiness, which pass into a profound sleep, accompanied by vivid dreams.

Opium is used, especially in the East, to a great extent, as a stimulant and narcotic, in the form of eating and smoking. Opium-eating has also extended over Western Europe and to this continent, and is more prevalent than is commonly supposed. The English author De Quincey, in his "Confessions of an Opium-Eater," has left an interesting record of the effects produced by the habitual use of opium. He speaks in glowing terms of the ecstatic condition into which he was first introduced by its use. He says: "Here was a panacea . . . . for all human woes; here was the secret of happiness, about which philosophers had disputed for so many ages, at once discovered; happiness might now be bought for a penny, and carried in the waistcoat-pocket; portable ecstasies might be had corked up in a pint bottle, and peace of mind could be sent in gallons by the mail-coach." But, by its continued use, the drug lost its stimulating influence, and no longer produced the beatific intoxication first experienced; and he describes in pathetic terms the terrible agony, mental and corporeal, which ensued when the habit became more and more confirmed.

This may be considered as a brief outline of the general effects of opium-eating. There is no hope for the victim of the habit except by renouncing the use of the drug. It is not expedient, however, to attempt to do this by one sudden effort, as its immediate deprivation is frequently dangerous, but by gradually decreasing the doses until the system has somewhat recovered its normal condition and can exist without it. The administration also of large doses of bromide of potash, while the cure is continuing, is serviceable in allaying the craving for the opium.

TOBACCO is so extensively used in all classes and societies, as a sedative and narcotic, that it merits a consideration from a medical point of view.

The tobacco plant is probably a native of the American continent, or at least was first cultivated there. It was introduced into England by the celebrated Sir Walter Raleigh, but was probably known at an earlier date to the Spanish and Portuguese, as it is stated that whole fields of it were under cultivation in Portugal as early as 1586. Soon after its introduction, the use of tobacco spread over Europe and Asia, and in fact over the whole civilized world, in spite of both religious and political opposition and persecution.

The active principle of tobacco is an alkaloid called *nicotine;* this is a colorless, volatile, oily liquid, with a strong odor and a burning taste. It is almost as powerful a poison as prussic acid; a single drop administered to a rabbit killed it in three and a half minutes.

A small quantity of nicotine is always found in tobacco smoke, but its proportion is undoubtedly influenced by the shape and construction of the pipe in which the tobacco is consumed. Thus, in the Turkish hookah, where the smoke is passed through water, a large proportion of the volatile oils is absorbed in its course. The reservoir of the German pipe, and the long stem of the Russian, also retain a large part of the oily and other products of the burning tobacco. The English and Dutch clay pipes retain least of any.

It is still a much-debated question whether the use of tobacco is positively injurious to the system, and its opponents have attributed to it an appalling list of disorders, — among them, appoplexy, paralysis, epilepsy, and other diseases of the nervous system, heart disease, etc. This wide assertion, however, cannot be said to be supported by experience, as there are very many habitual smokers who live to an advanced age, and, as a general rule, the moderate smoker is as healthy as the non-smoker. It is also said that the use of tobacco is incompatible with the highest energy, mental and physical; but when we consider the intellectual workers who have used it,—Sir Isaac Newton, Addison, Carlyle, Tennyson, Longfellow, and hosts of others in every branch of arts, sciences, and business,—we cannot even admit this without some reservations.

However, it is undoubted that the use of tobacco conduces slightly to a condition of inertia, or indolence; and it is injurious always when used in excess. The limits of moderation must be decided by each individual for himself, as what might be considered within bounds for one may be greatly in excess for another. For some constitutions, also, tobacco in any quantity is poisonous, and by them it should always be avoided. The use of tobacco by boys should be peremptorily condemned, as its effect on the immature system is universally admitted to be pernicious. It is said to enervate both mind and body, to stunt the growth, and to produce an abnormal precocity in the young.

Medicinal Uses of Tobacco.—Smoking increases the flow of saliva, and it is therefore maintained by many, on this account, that it aids digestion, and is useful in dyspepsia. An old poet tells us that—

> "It helpeth digestion,
> Of that there 's no question;
> The gout and the toothache it easeth;
> Be it early or late,
> 'T is never out of date;
> He may safely take it that pleaseth."

Tobacco also acts as a slight purgative, and a pipe or cigar smoked after breakfast is often sufficient to insure an easy and satisfactory relief of the bowels. The practice is not without advantage for persons troubled with *habitual constipation.* Tobacco is often used with advantage in spasmodic asthma. It is usually unsafe to use tobacco as an external application, as sufficient may be absorbed to produce symptoms of poisoning.

NURSING AND CARE OF THE SICK.—The treatment of disease of the present day does not consist merely of giving remedies, but also in careful attention. Many diseases, even of a dangerous character, require more care and less drugging than was formerly resorted to.

We should remember that nursing is not of secondary, but primary importance. The administration of remedies is but bringing art and science to the assistance of nature. Nursing is essentially a practical matter. There is no theory in nursing, and there is not much learned by merely reading works written on this subject. Patience and attention are the two cardinal points in a successful nurse.

The Qualifications of a Good Nurse.

1st. She should be strong physically: her occupation involves confinement to the house, and other hardships, which a robust constitution is alone able to stand.

2d. She must not be too big; a heavy, lumbering woman is an annoyance in the sick-room.

3d. She ought to possess activity of mind as well as of body,—quick to apprehend and quick to perform.

4th. Mentally she should be calm and of an equal temperament; not given to flurry and unnecessary haste, but able to perform her task without needless delay, and be careful in all details.

5th. She should be of a cheerful disposition, for it is well known a cheerful nurse makes a cheerful patient.

6th. She should be of a non-talkative disposition. The most annoying and irritating person that can enter a sick-room is a talkative woman.

7th. She should be of a patient disposition, never showing annoyance at being asked to do anything.

8th. She should be of a gentle nature when arranging the patient, doing it with a gentle hand.

9th. She should have a good memory, to be enabled to give the attending physician all the details of the progress of the patient, and any new symptoms which might have arisen. Should she be deficient in memory, she should keep notes of the case in writing.

The *dress of a nurse* ought to be of some light material, simple in make, free from all needless trimming, and scrupulously clean, both for her own safety and for the sake of those with whom she comes in contact.

She should wear a neat cap and soft shoes; and a pin-cushion and a pair of scissors carried from a girdle will be found of great service. Above all things, her general appearance should be one of neatness and cleanliness.

Selection of a Sick-Room. — The room in which a person is confined to bed with a serious and protracted illness should be the best it is possible to obtain, — sunny, and at the same time quiet. It should be large, lofty, and well ventilated. The window-shades ought to lower from the top, as well as raise from below, and should work with but little noise. The door should open and close without a jar.

Let the furnishing of the sick-room be simple as possible. The floor should be uncarpeted, and all unnecessary furniture banished; there is no need of trunks, band-boxes, etc. There ought to be at least two tables,—one of a small size, on casters, to run to the side of the bed for immediate use of the patient; and the other stationary, for the reception of medicines, glasses, etc. No looking-glass should be placed so that the patient can see himself. A lounge or sofa is of great utility, especially during convalescence. Two or three chairs, one of them an easy-chair, and a washstand with plenty of clean towels, are generally needed.

The *bedstead* should be of small size, not too wide, and placed with its head against the wall, to allow free access on either side, the best arrangement for it being between two windows, and without curtains around it. Iron bedsteads are to be preferred to wooden ones. Hair mattresses are preferable to those containing feathers.

A very excellent mattress for sick persons is the "Patent Woven Wire Mattress," which is a strong fabric of wire interwoven in all directions, making it very elastic, and causing it to yield to the slightest pressure. When this mattress is used, it is usually sufficient to place three or four folds of a blanket over it. Water or air mattresses are also very comfortable, and especially useful in chronic cases, as they prevent the constant pressure from inducing bed-sores. There are also many ingenious beds in use for the sick, which can be lifted or lowered at pleasure.

The *bed clothing* must be light; counterpanes and coverlets must be discarded from the sick-room, and only good, light blankets be employed. The pillow-cases and sheets are better of cotton than of linen. They should be placed smoothly over the bed, and changed frequently, — daily in the case of infectious fevers. The bed the patient lies on ought to be absolutely flat and perfectly smooth. When a blanket is placed between the mattress and the bottom sheet, it is necessary to take great care that no wrinkles or inequalities are left in it. The bottom sheet must always be protected as far as possible from everything likely to soil it. Since it is very desirable not to disturb the patient oftener than is absolutely necessary, this may be done by the means of *draw-sheets*, which are placed under the middle of the patient, or under any part of the body where a discharge is issuing or likely to issue. Draw-sheets are made of old sheeting doubled and sewed together, their size depending upon the requirements of the case. These should be removed as soon as they become soiled. The sheets and blankets should be tucked in well around the bed.

The coverings of the patient induce pain by their pressure, as in a fractured leg, inflamed knee, or peritonitis. It is best to use a cradle or bed frame. This is a very simple contrivance, and one which in cases of necessity may be readily extemporized by a carpenter of ordinary intelligence. The accompanying wood-cut represents those in ordinary use. It is a great relief to a patient to change his position in bed, especially to alter the angle of his body. This of course may be done by means of pillows ; but bed back-rests, such as shown in the annexed figure, are a great convenience and comfort to individuals, as by their help they can be sustained at any angle in bed without feeling fatigued.

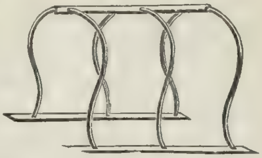
FIG. 31.—Bed-Frame or Cradle.

Bed-Pans.—These should be used in all cases in which there is debility, or when it is desirable for the patient to remain quiet, as in fractures. The best bed-pan for ordinary use is the well-known round pan. After the pan has been used, it ought to be removed immediately from the room, and emptied and well cleaned before being brought back. In case of infectious diseases, a strong solution of copperas and carbolic acid should be thrown into it before removal.

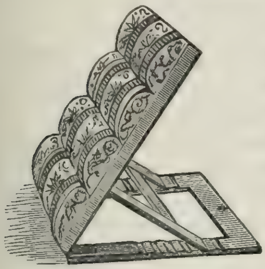
FIG. 32.—Back-Rest.

Urine Bottles are also a great comfort to invalids: they are wide-mouthed, big earthenware bottles, flattened on one side to prevent their being overturned. It is important to bear in mind that the bottles should be removed and washed immediately after being used, and not allowed to remain in the room.

The following articles must *not* be allowed to remain in the sick-room: dirty linen, implements of cooking, prepared food, medicines discontinued by the physician, soiled cups or glasses, slop basins or pails. The latter indeed should never enter the sick-room. Let all articles requiring cleansing be taken from the room.

Ventilation and Air of the Sick-Room.—It is of the utmost importance that the air of the sick-room be gradually but continuously replaced by pure air. The prejudice against the admission of fresh air into the chambers of the sick is fortunately a thing of the past.

There is little danger, with ordinary precautions, of taking cold while lying in bed. A draught, however, need not be created by opening a window and door. If the bottom sash of the window be pulled a little upwards and a piece of board placed between the bottom of the sash and the sill, air will enter at the opening left between the junction of the two sashes, and the current will travel upwards to the ceiling and not laterally. But it should be the object of the nurse not only to see that fresh air is admitted, but to keep that already in as pure as possible, and this can only be accomplished by the removal of everything that possibly could induce an impure condition.

Food should *never* be cooked in the sick-room, nor that which has been brought in allowed to remain; smoking kerosene lamps, gas, etc., contaminate the air, but light is necessary. The lamp may be placed in the hall, or a lantern hung outside of the window, admitting the light into the room. Wood-stoves are far preferable to coal-stoves ; in any case, all the flues must be closed and no gas allowed to escape. A tin of water should be placed on the stove, so that the air may not become too dry. When the room is heated by hot air, it is well to place a basin of water near the registers, or a basin of boiling water occasionally beneath. This leads us to speak of the temperature.

The only way to be positive in regard to the warmth and temperature of a room is by a thermometer, and every sick-room should contain one. The best temperature is 60°; if, however, the patient feels chilly at this temperature, it may be raised three or four degrees. In fevers and nervous troubles the temperature may even be lower than this, at about 50°; but in affections of the chest, especially consumption, 65° is the most agreeable to the patient.

Cleaning the Sick-Room.—It is important to keep the sick-room well cleaned, and the best time to clean it is the morning. If, however, the patient has not had a good night's rest, or if he has been restless and unable to sleep during the night, and is inclined to sleep during the morning, it will be well to delay the cleaning until he obtains some rest. Cause as little dust as possible to be raised; if the floor be covered with a carpet, sprinkle moist tea-leaves over it, and then sweep it lightly with a hand-brush or broom. All soiled articles should be removed, and only those necessary be returned after washing.

Sunlight.—This is very essential in most cases and should be freely admitted, all blinds and curtains being removed, so that plenty of it may enter. In a few cases, however, such as brain inflammation, light only increases the violence of the pain. When the patient has been restless during the early part of the night but has fallen asleep towards morning, light should not be admitted into the room, as it would have a disturbing influence.

The *sick-room* should be kept *quiet;* this is universally admitted, and extraordinary precautions are sometimes taken to insure quiet. Sudden startling noises are the ones that annoy the sick most.

"Unnecessary noise," says Miss Nightingale, "or noise that creates an expectation in the mind, is that which hurts a patient."

Never enter into conversation in the sick-room, unless you expect the patient to participate. Unnecessary questions, such as, "Shall I close the door?" "Will you have your medicine now?" etc., should be avoided. They often give rise to argument, which is frequently productive of injury.

Keep visitors away, unless the patient has a strong desire to see them, and even in that case permit them to remain but a short time. It is well known that they occasion an increased nervous excitement; this is shown by the flushed cheek, quick pulse, rapid breathing, etc. If these symptoms manifest themselves in the patient after a visit of a friend or relative to the sick-room, a second call ought to be strictly forbidden. Some sick persons are literally and actually *talked to death.*

Administration of Medicines.—Medicines should be given at regular intervals, and strictly in accordance with their directions. If the patient be asleep when the hour arrives for its administration, let him not be disturbed except in particular cases.

Liquid medicines should never be measured out with a spoon; a graduated medicine-glass ought to be in every sick-room. If the medicine be an acid and the spoon used be not silver, the medicine may become injurious and rendered poisonous, instead of being beneficial. Medicine should be taken well diluted.

Powders, if in small bulk, may be mixed with a little jelly or sugar and taken from a spoon. When the powder is unusually large, it may be mixed with water or mucilage.

Pills may be easily swallowed by placing them on the tongue and taking a mouthful of water; in swallowing the water, the pills will be washed downwards.

Feeding.—Food should be nicely prepared, and of nutritious and strengthening quality. (See "Recipes for the Sick.") When the patient is strong enough, he may be propped up and have a tray placed in front of him; or, still better, a small bed-table, which is hollowed out to fit well around the front of the body. When he is too weak to be lifted, a pap-bowl may be used with advantage. The quantity of food taken at one time ought to be limited in amount. It is far better to give it often than to overload the stomach.

Personal Attention to the Sick.—If there exist a chilly feeling of the hands and feet, or surface of the body, and the temperature be of a correct height, let hot-water bottles, warm bricks, or sand-bags be placed in the bed with the patient.

The *skin* of the patient should be kept clean by occasionally sponging it with tepid water. A little alcohol or vinegar added to the water would be beneficial. Great care must be taken, when sponging the body, to see that no windows or doors are open; and only small portions should be sponged and dried at a time. Sponging every day, in some cases, is very advantageous. Wash the feet at least twice a week, and the hands and face every day, or twice a day.

Make the bed look neat and tidy after each meal, and leave no remnants of the food lying around.

The *bed linen* will need to be changed twice a week, and, if soiled, oftener. It should be well aired and warmed before spreading. "To change the bottom sheet of a helpless patient is an operation which demands some skill from the nurse. The clean sheet ought to be rolled, not folded, and the soiled one unloosed from the head, and rolled downward, at the same time placing the clean sheet over the upper part of the bed and making it fast; and as one is rolled up, the other should be unrolled. The patient, during the time, should be propped or held up by an assistant. As soon as you have arrived at the buttock, the difficulty arises. By fastening a jack-towel to the end of the bed, a patient with some strength may be able to assist by lifting himself. If too weak, he will have to be helped by an assistant. As soon as the soiled sheet has passed the buttocks, one pull will be sufficient until you have passed the clean one under the buttocks and thighs. The latter part, of spreading it under the legs, is easily accomplished. Great care must be taken to have it smooth."

The body linen should be changed once a week, or oftener in some cases, especially if soiled. Do not begin until you have everything at hand. See that there is no draft, and that fresh air has been well warmed. Avoid moving or uncovering the patient more than is absolutely necessary.

In cases of low fever, it is a good practice to change the position of the patient, and not allow him to remain too long on his back. In this way the frequent complications of pneumonia may be prevented. It is also necessary to look occasionally about the back and buttocks, to see if there are any bed-sores. If there be only redness, it should be sponged with alcohol and water, and a pad of soft lint, or, still better, a rubber ring filled with air or water, placed under the body.

INDICATIONS OF DISEASE.

The indications of disease are numerous; it is by their help that a physician is led to the source of the disease, or organ diseased. They are, however, significant only when they are combined with other symptoms, and occur in those who have not previously labored under them. By themselves, they denote nothing. In children, or in those who are unable to communicate their feelings, they are of particular value.

Modes of Lying. —Lying *constantly* on the *back* indicates some trouble of the brain or spinal cord; constantly on the *abdomen* and *chest*, in colic; on the *back* with the knees drawn up, peritonitis, or inflammation of the intestines; on one *side*, in pleurisy, pneumonia, and the late stages of consumption.

When the patient is unable to lie flat and finds great relief in a half-sitting posture, it indicates disease of the heart or lungs; head thrown back, some trouble in the larynx or windpipe.

Restlessness is found in the invasion of acute inflammations or fevers; also in delirium and mania.

SLEEP. — Disturbed sleep may be due to, —

1. Dyspepsia, or excessive use of tea, coffee, alcohol, or tobacco.
2. To an excessive amount of blood in the head.
3. Excessive mental work.

Grinding of the teeth and twitching of the limbs in children, during sleep, denote worms.

Dreams of a frightful nature, with palpitation of the heart, indicate heart disease.

EXPRESSION. — Elevated brow indicates neuralgia of the scalp; contracted brow indicates distress, anxiety, anguish, or severe internal pain.

A constant look of anxiety is found in acute disorders; it is noticed in diseases of the heart and of the abdominal organs.

Bashfulness, diffidence, inability to look one manfully in the eye, occur in masturbation and impotence. An indifferent look, combined with brightness of the eyes, is found in chronic disorders unattended with pain.

The patient is sad and desponding in liver troubles.

Lips, when swollen, in children, indicate commencing consumption. When the *angles* of the *mouth* are *drawn down*, some stomach or intestinal trouble may be suspected in children.

The *face becomes flushed* in fevers; should only one cheek be flushed, and it is accompanied with pain in the chest, pneumomia may be suspected.

The *cheeks become flushed* during the afternoon in commencing consumption.

During the early stages of brain disease, the *forehead* is alternately flushed and pale.

Swelling under the eyelids, especially in the morning, is often the first indication of kidney disease.

Dilated nostrils, with rapid breathing, in children, denote lung disease.

INDICATIONS OF DISEASE OBSERVED FROM THE EYE. — *Dilated pupils* are found in apoplexy, dropsy of the brain, or poisoning from belladonna or prussic acid. The pupils *become contracted* in inflammation of the retina of the eye, also in the early stages of inflammation of the brain. Poisonous doses of opium produce the same effect on the pupils. If there is any difference between the *size* of the two pupils, some brain trouble may be apprehended.

Those persons who suffer from *spots floating* before the eyes, in a great majority of cases, require iron tonics, as it usually occurs in debility and *anæmia;* it is, however, also met with in dyspepsia and liver troubles.

Rolling of the eyes in children denotes either some nervous irritation or brain disease.

Seeing double often occurs in irritation of the stomach.

A *dark circle* around the eyes in women indicates uterine irritation.

EARS. — *Ringing* in the *ears* is met with in nervous debility, or in congestion of the brain. *Loss of hearing* is often caused by the accumulation of wax in the ear, cold in the head, or the excessive use of quinine. Softening of the brain also induces it, besides disease of the ear itself.

VOMITING without nausea occurs in brain disease. Vomiting shortly after eating is met with in dyspepsia or indigestion. When vomiting occurs shortly after eating, and the vomited matters are mixed with blood, the pain which was present being relieved, ulcer of the stomach may be suspected. Cancer of the stomach is attended with constant pain, and the vomited matters resemble coffee-grounds.

Vomiting also occurs during many fevers, and its occurrence in the morning, in women, is an indication of pregnancy.

HEARTBURN and waterbrash indicate that the stomach is in an unhealthy condition, or that the food taken is too rich.

TONGUE. — An enlarged, soft-looking tongue is always present in debility; red, and having the appearance of a raspberry, accompanied with severe fever, in scarlet fever. The tongue is furred or coated in indigestion and fevers. When the tongue becomes pointed, with tip and edges red, some irritation of the stomach or intestines may be suspected.

TASTE. — A bitter taste in the mouth, especially in the morning, indicates that the stomach or liver is out of order. Those who suffer from an acid condition of the mouth are dyspeptic. In *consumption*, there is a taste of salt constantly present in the mouth.

DIFFICULTY IN SWALLOWING is always present in inflammation of the throat, but it may also occur from stricture or contraction of the pharynx or œsophagus. A tumor or abscess pressing on the back of the throat also induces difficulty in swallowing, and in general debility it is often present.

BLEEDING from the *nose*, in persons not subject to it, often indicates a commencement of typhoid fever. It also occurs in congestion of the brain.

Bleeding from the *bowels* in a healthy person is occasioned by internal piles. After fevers, especially typhoid, it indicates a serious complication, either rupture of a blood-vessel or of the intestines.

Bleeding from the *bladder* or *kidneys*, when no injury has been received, indicates either stone in the bladder, or congestion or inflammation of the kidneys.

APPETITE. — Sudden loss of appetite is met with in the commencement of acute disorders. When tne appetite is excessive, it indicates some nervous trouble or diabetes. When irregular and perverted, worms or hysteria may be suspected. A return of the appetite during sickness indicates convalescence.

THIRST. — Excessive thirst occurs during fevers, and in diseases of the stomach and bowels, and also in diabetes. *Thirst* is diminished in some brain diseases. Deficiency of saliva occurs in fevers, also in chronic disorders of the throat and stomach.

TEETH. — Rapid decay indicates some impairment of the constitution.

GUMS. — When they become soft, swollen, and spongy, prone to bleed on slight irritation, it indicates a low state of the blood, such as scurvy. A blue line along the gums indicates lead-poisoning, while a red line occurs in the commencement of consumption. A white, pale condition of the gums denotes a want of blood.

DIARRHŒA. — In children, while teething, diarrhœa indicates that the gums should be lanced.

Stools like the white of an egg, resembling water, occur in cholera, and in inflammation of the large intestine; clay-colored, indicate deficiency of bile; and yellow or dark-brown, excess of bile.

URINE, if excessive, indicates diabetes. It is diminished in fevers, congestion or inflammation of the kidneys. A constant desire to urinate indicates some disease of the kidney or bladder. It is dark in inflammatory fevers. A deposit of red or yellow sand occurs in dyspepsia, acute inflammation, rheumatism, consumption, and also from the checking of perspiration, as by a severe cold. A white deposit indicates a depressed state of the nervous energy, and is of serious importance. When it is cloudy, disease of the bladder may be suspected. Sudden inability to urinate, when not following an injury, indicates spasm of the muscles, and a hot hip-bath should be used. Gradual development of this trouble, especially after disease of a private character, requires immediate surgical attention.

WALKING. — Constant tripping in an adult indicates the commencement of some spinal disease. If the patient be unable to walk in the dark, *locomotor ataxia* may be suspected. Should difficulty in walking occur in children who have previously walked well, some brain disease may be suspected, and it should have immediate attention.

Trembling of the limbs indicates excessive use of alchohol, tobacco, tea, or coffee. If these have not been used in excess, the commencement of disease of the brain or spinal cord should be suspected.

RAPID BREATHING on slight exertion indicates a want of blood corpuscles; it also occurs in consumption, dropsy of the chest, and heart disease.

COUGH. — When *dry* and *hollow*, it indicates some nervous affection; it is *dry* and *tight* in early bronchitis; *soft, deep*, and *loose*, in advanced bronchitis; *hacking*, in early consumption; *deep* and *distressing*, in advanced consumption; *short* and *sharp*, in pneumonia; *barking* and *hoarse*, in early or spasmodic croup; *whistling*, in advanced membranous croup, occurring in paroxysms with a *whoop*, whooping-cough.

EXPECTORATION is *frothy* in catarrh, in early bronchitis, and in the first stage of consumption; *thick* and difficult to get up, and sometimes streaked with blood, in early bronchitis; *thick* and *heavy* in chronic bronchitis and consumption; *dark*, resembling iron-rust, in pneumonia; *putrid* in gangrene of the lungs.

THE HEART. — *Palpitation* of the heart, occurring after mild exercise, indicates either some lung or heart disease, or, more often, thinness of the blood. Palpitation during the night occurs in nervous persons, and in those who indulge in stimulants of any kind. Dyspeptic palpitation occurs usually shortly after eating.

PAIN. — There are two classes of pain, — first, that which goes under the name of nervous or neuralgic pain; and, second, that which is due to inflammation. In the first the pain is not increased by pressure, but sometimes is greatly relieved by it; whereas inflammatory pain is always increased by any weight or pressure. In a great majority of cases, the inflammation terminates in suppuration, or the formation of pus or matter; when it does so, the pain changes its sharp, stabbing character to a dull, heavy sensation.

Sometimes the situation and character of the pain assist a physician in arriving at a conclusion as to the disorder and the formation of a diagnosis. For instance, if a tumor has existed in the breast for some time, accompanied with sharp, stinging, or stabbing pains, he will infer that the patient is affected with cancer of the breast. Again, a sharp, stabbing pain under the nipple, together with fever, is indicative of pleurisy; while a soreness under the breast-bone usually accompanies bronchitis. A constant dull pain in the right shoulder-blade is commonly complained of in chronic affections of the liver. A severe pain in the head, which is increased by the slightest sound or light, may be put down to inflammation of the brain or its membranes; while a dull, heavy, throbbing pain may indicate congestion of the brain.

Temperature. — The temperature of the body is one of the most important indications of disease. It not only greatly assists in the diagnosis of the disease, but also enables a physician to make a prognosis as to its probable severity. The temperature can be accurately ascertained only by a clinical thermometer, which is furnished with an automatic register. It is usually placed in the armpit, or in the mouth beneath the tongue, where it is allowed to remain for about five minutes. The normal temperature of the human body is 98.5°. A rise in temperature of 1° corresponds to an increase in the pulse of 8 or 10 beats per minute.

When the temperature is increased beyond 98.5°, it merely indicates that the individual is ill; if it be above 105°, it indicates imminent danger; a temperature of 108° or 109° is usually fatal, and death may be anticipated in a short while.

A rapid increase in temperature to about 104° or 106°, in a person well the day previous, does not as a rule indicate anything serious; it will probably turn out malarial fever.

If a patient's temperature rises to 103° or 104° during the first day of an illness, typhus or typhoid fevers can be excluded. Should symptoms of pneumonia be present, and the temperature not rise above 101.7°, it can safely be stated that no inflammation of the lung is present.

If, during measles, a high temperature be retained after the rash has faded, some serious complication is present. In typhoid fever, a temperature that does not exceed 103.5° indicates a mild course of fever; 105° in the evening or 104° in the morning shows danger, in the third week.

In pneumonia, a temperature over 104° indicates a severe attack.

In acute rheumatism, a temperature of 104° is always an alarming symptom. A low temperature of the body indicates a languid circulation.

Coldness in the *hands* and *feet* occurs in nervous and anæmic persons, while warm extremities are found in the early stages of consumption.

Perspiration. — When perspiration becomes established during fevers, an improvement is indicated. In rheumatic fever, perspiration is profuse and acid.

Night-sweats occur in consumption, or in any condition where debility is great.

Diminished perspiration, or a dry condition of the skin, is seen in the early stages of acute diseases; also in dropsies and diabetes.

Pulse. — The indication derived from a careful examination of the pulse is very important. We judge by the pulse the force of the heart's action, the excitability of the nervous system, the fulness of the blood-vessels, and the physical condition of the arteries. The average number of pulsations in a healthy adult male are 70, in the female 75, per minute. The pulse of fever is characterized by moderate acceleration, with variable increase of force in the beat.

The pulse of inflammation is not only accelerated, but hard or tense, and commonly full. The pulse of nervous irritation is usually quick and variable in rapidity and force under excitement, or during repose. When the pulse becomes irregular or intermittent during fevers, the condition of the patient becomes serious.

HEALTH AND DISEASE.

"Health" admits neither of definition nor description, — of none, at least, which can be applied to any useful purpose. If we define it as the integrity of every structure, and perfect and harmonious play of every function, we give a true definition, but not a useful one. Perfect health, like perfect beauty, is perhaps an ideal compounded of the perfections of many different individuals. Health, in its more usual acceptation, is a variable condition, and differs widely in different persons, and in the same person at different times. The terms "perfect," "good," "strong," "feeble," "robust," etc., applied to health, show how generally the difference in degree is recognized.

The definition of "disease" may be briefly said to be a perversion either of the functions or the structure of the body, or of any of its parts. In the following pages we have given the cause, symptoms, and treatment of those diseases most commonly met with. There are, however, some exceptions, such as diseases of a private nature, which have been altogether excluded, — firstly, because their nature is such that, in a work for general reading, they would be out of place; and, secondly, because it is far wiser for any one suffering from them to consult a physician: for, although the symptoms may be slight, the germs of a lifelong misery may be hidden away and escape the notice of any one, except those who have had experience in their treatment.

In the treatment of disease, we have selected those remedies which are most efficacious. But we would strongly impress upon the reader, that where medical aid can be obtained, it should always be done. It is sometimes difficult even for the most experienced physicians to find the seat or cause of disease, and how much more so must it be to those who are perfectly ignorant of the physiology of life and the pathology of disease!

Let the use of domestic remedies be restricted to those diseases which are simple, or call for prompt action. What we mean to express by "simple diseases" are those which from their symptoms preclude any mistake as to their character.

DISEASES OF THE BRAIN. — The brain, like the other organs of the body, is liable to many diseases, and it is not always easy to detect their nature. It is a very complicated organ, and physiologists are not yet agreed as to the function of each part. We can ascertain the condition of most of the internal organs by different modes of examination with almost as much certainty as if we could see them. Thus, diseases of the heart or lungs can be ascertained by sounding and listening at the chest; disorders of the stomach, by the appearance of the tongue; or disease of the kidneys, by the appearance of the urine, etc. But, in diseases of the brain, we are cut off from these methods of examination, and the information derived from the patient himself is frequently unreliable. Some slight disorder of the stomach or liver may produce temporary confusion of the intellect, and these are sometimes exaggerated into serious symptoms.

We frequently meet persons who are overworked or worried in their business, who get anxious and despondent, and think they have some disease of the brain or are going mad. This is usually the result of overwork, and, in nine cases out of ten, means nothing serious. A little rest, with change of scene and a few doses of bromide of potassium, fifteen grains dissolved in a little water three times a day, will usually dispel these symptoms. Phosphorus also, or hypophosphite, is an excellent remedy, as phosphorus is a brain food.

Deficient supply of blood to the brain also gives rise to disagreeable symptoms, and more especially to headache. The pain is usually felt in the temples and at the top of the head, and is sometimes of a throbbing character, and sometimes of a sensation of weight and pressure on the head. The headache may also be accompanied by rumbling noises in the ear, and a general sense of pulsation all over the body. This is usually due to impoverishment of the blood, and can be corrected by plenty of nourishing food, iron tonics, etc.

CONGESTION OF THE BRAIN is occasionally met with in the course of different fevers, or it may occur independently of any other disease. Aged persons, whose tissues and blood-vessels are weak, are not infrequently subject to this disorder. Congestion of the brain and its remedies will be found under "Apoplexy."

Softening of the Brain most frequently occurs in those whose health has been for some time below the average, or in those who are the subjects of some chronic and exhausting disease. It occurs most commonly in those who are over the age of fifty. Its premonitory symptoms are usually headache, more or less severe and persistent; giddiness, dulness of the intellect, and depression of spirits. The vision becomes impaired, and the mental powers continue to decline. If there is any suspicion of a tendency to softening of the brain, the patient should be immediately placed under medical care.

Some other affections of the brain will be found treated elsewhere.

Apoplexy is the result either of congestion of the brain, or from the rupture of a blood-vessel allowing extravasation of blood about the brain. Florid, short-necked, big-bellied people are thought to be the most exposed to it. Cause: Full living, with alcoholic intemperance, associated with indolent habits, predispose to it in a marked degree; so also does suppression of usual evacuations, intense study, etc.

Symptoms.—The attack is sometimes sudden; in other cases, it is preceded by various premonitory symptoms, such as giddiness, headache, a sense of pressure or constriction in the head, confusion of ideas, hemorrhage from the nose, flashes of light, noises in the ear, faltering speech, loss of memory, drowsiness, numbness of the extremities, pallor, vomiting, and faintness. These symptoms are succeeded by complete loss of all power, and the patient lies in an insensible condition; the breathing becomes slow and loud, the face flushed, sometimes purple, and the pupils dilated; the arteries throb violently in the neck, and the pulse is slow and full. Sometimes there is foaming at the mouth, grinding of the teeth, and twitching of the muscles of the limbs. This condition continues for a variable time, and often results in paralysis; or the patient is seized with vomiting, and recovers after a profuse sweat.

Treatment.—The first and most important thing to be noted is, not to mistake dead-drunkenness for apoplexy (see "Alcoholic Poisoning"). The next thing is, to send for your doctor; in the mean time two or three drops of croton oil should be rubbed up with butter and placed on the back of the tongue, after the patient has been placed in a position so that the head is well raised. If croton oil cannot be obtained, an injection into the lower bowel of soapsuds, castor oil, and molasses should be made, and mustard plasters applied to the calves of the legs, and hot bricks or bottles to the feet. Cold should be applied to the head in the shape of water, or, still better, ice. All tight clothing about the neck should be loosened, and cool air be allowed to enter the room.

Those persons subject to apoplectic attacks, or who are full-blooded and stout, should be careful not to lift heavy weights, or to strain while at stool. They should sleep with their heads well elevated, or try and reduce the quantity of blood by the means recommended in plethora or full-bloodedness.

Insomnia, or Inability to Sleep.—Apart from pain, there are many other conditions which cause sleeplessness, and the treatment will greatly depend upon the cause. If it be due to overwork of the brain, entire rest from the exciting cause should be taken, and the mind should be diverted and amused so as to allow it to resume its normal condition. If it be due to debility, the system should be brought to a healthy condition by the use of generous diet and tonics. If it be due to an accumulation of blood to the brain, indicated by a throbbing sensation in the head, a brisk walk, or exercise with dumb-bells should be resorted to before retiring; if these means fail, a hot foot-bath, or cold applications to the head, will usually have the desired effect. Should the sleeplessness be due to craving for food which is sometimes experienced about bedtime, then some light and easily digested food may be eaten. Drinking strong coffee or tea in the evening has sometimes the effect of causing wakefulness, and it would be well in that case to discontinue their use.

Some persons feel a drowsiness before retiring, but after getting into bed find themselves unable to sleep; in these cases the head and shoulders should be well raised, so that the flow of blood from the head may be assisted by the gravitation downwards. A warm room, reading exciting novels, etc., are frequently causes of wakefulness, and the remedy will consist simply in their discontinuance. Should the sleeplessness be continued, without any obvious cause, then a physician should be consulted, as there may be some organic disease of the brain.

Among the simplest remedies for insomnia are the use of hops, either in a draught of beer, or in the form of a pillow stuffed with hops; lactucarium; bromide of potash in ten or twenty grain doses; hydrate of choloral in ten or fifteen grain doses. These are not likely to be followed by the disagreeable symptoms that are apt to be produced by the use of opium.

SUNSTROKE, *coup de soleil*, insolation, or heat-apoplexy, as this complaint is variously called, is a congestion of the brain caused by excessive heat from the direct rays of the sun. There is a second variety of this complaint, known as heat-stroke, which is also caused by excessive heat, but which is not due to the direct rays of the sun, and may even occur in the nighttime. The symptoms of the first variety are similar to those of apoplexy, and its treatment is the same in all particulars as of the latter. (See "Apoplexy.")

HEAT-STROKE, or heat-exhaustion, is of rather more frequent occurrence than sunstroke. This complaint is due not only to excessive heat, but also to a certain condition of the atmosphere. It seems to occur most frequently in hot, "muggy" days. Its symptoms closely resemble those of a fainting fit; the head becomes giddy, accompanied with ringing in the ears and dimness of vision. If the patient be standing, he falls to the ground in a more or less unconscious condition, the face becoming very pale and the pulse very weak.

Treatment. — The patient should be placed in a recumbent posture, with the head very low. Cold water or ice should be applied to the head and face, the object being to cool the blood. As soon as this has been done, a mustard plaster should be applied first to the spine, and afterwards over the stomach, and lastly to the calves of the legs. If the symptoms of fainting are very prominent, ammonia should be applied to the nostrils for a few moments; and, if the patient is not too unconscious to swallow, ten drops of aromatic spirits of ammonia should be administered every fifteen minutes, until symptoms of improvement appear.

These rules are given for cases of emergency; but of course medical assistance should be summoned as quickly as possible, as this complaint is very dangerous, and requires experienced attention.

DELIRIUM TREMENS is still, unfortunately, a common disease in this country. It is usually due to excessive indulgence in alcoholic drinks, but may also be occasioned, in steady drinkers, by a mental shock or a physical injury.

Symptoms. — The first symptoms to appear are restlessness, inability to sleep, and trembling of the muscles of the limbs and tongue. As these symptoms increase, the patient talks incessantly in a rambling fashion, and fancies that some great evil has befallen him. He is suspicious of those about him, and is tormented by frightful images, such as snakes, insects, or monsters, which he endeavors to escape from. The skin grows clammy and cold, and the pulse beats irregularly. The patient finds himself unable to obtain any sleep, or, if he gets any, it is disturbed by horrible dreams and visions. The first attack of delirium tremens rarely proves fatal, but each succeeding attack is likely to be more and more dangerous. In favorable cases, the patient falls into a heavy sleep about the third or fourth day, from which he awakes free from delirium, but exceedingly weak. A sleep of eleven or twelve hours is usually followed by convalescence; but if the wakefulness continues, and the patient is unable to sleep, the case becomes critical.

Treatment. — The patient should be at once put to bed in a quiet, darkened room, and all disturbing influences should be excluded. Narcotics are frequently used for inducing sleep; but, as the quantities and administration of such depend upon the condition of the patient, his constitution, etc., they should only be administered by an experienced physician. A mixture of equal parts of the fluid extract of lupuline and tincture of capsicum may be administered in teaspoonful doses every two or three hours. Strong black coffee has been also found serviceable in this disease for its stimulating effects.

It is of vital importance that the patient should be well supplied with nutritive food. This cannot be given in a solid form; but beef-broth or soup, or the whites of eggs with a little lemon-juice and plenty of milk, should be taken. The addition of plenty of Cayenne pepper to the broth or soup is often beneficial to allay nervous excitement.

If the patient is youthful, and the attack is due to an excess, alcoholic stimulants should be dispensed with; but if the patient is old and feeble, and has been habituated to alcohol, small and often-repeated doses of wine or brandy may be allowed.

PAIN IN THE HEAD, OR CEPHALALGIA.

(1.) This may arise from neuralgia, which is mostly on one side, extending more or less to the face, and the pain is of a shooting or darting character.

(2.) Rheumatism of the head is attended by stiffness of the muscles which move the head.

(3.) Congestive headaches are accompanied by heat of the head, and the pain is throbbing or pulsating.

(4.) Headaches induced by uterine irritation are situated on the top of the head.

(5.) Pain from chronic disease of the brain is constant or periodic in one spot, and usually attended by some disorder of the brain.

Headaches are often induced by disorders of the stomach or intestines, and also by liver troubles.

Debility also produces headaches, and the use of certain medicines, etc.

Treatment will depend upon the cause. Aconite ointment is recommended in neuralgic headaches; arsenic when there is pain in the brow; blue-pill, bromides, or coffee in sick-headache; cathartics when due to constipation; cannabis indica when due to fatigue; cold applications to the head when due to menstrual disorders; tea or coffee in nervous headaches, and also valerianate of zinc.

Congestive headaches are best relieved by bromides or gelsemium. A handkerchief tightly tied around the head is a common remedy.

Headache from brain disease will be treated under "Diseases of the Brain."

HYDROPHOBIA. — This disease is due to the introduction into the system of a special poison contained in the saliva of animals affected with rabies. It occurs in many species of animals, but is most frequently met with in the dog.

It is a popular belief that dogs become mad only during the "dog-days," or in the hot season; but in reality, rabies occur just as frequently in the spring or autumn, or even the winter, as in the summer. When a dog shows any premonitory symptoms of madness, such as dulness, unusual irritability and snappishness, depravity of appetite, as in eating straw, dung, earth, etc., and other marked symptoms, it is advisable to isolate him, or even kill him, before he has an opportunity to do any harm.

Hydrophobia is of very infrequent occurrence, and not every one that is bitten by a rabid animal contracts the disease. In fact, it is estimated that only five per cent of the cases suffer from it. This may perhaps be due to a particular susceptibility in some persons, but most probably it depends upon the position of the bite. If the wounded part is defended by clothes, the chances are that the saliva will be wiped off before the animal's teeth reach the flesh, and therefore no inoculation takes place.

The *symptoms* produced by hydrophobia in man commence gradually, and it is sometimes several months after being inoculated that they first make their appearance. After an uncertain period, varying from several weeks to several months, there is felt an uneasy sensation about the seat of the wound, followed by darting pains along the course of the nerves. In a short time the symptoms become more marked; restlessness, spasmodic contractions of the limbs, sighing, great anxiety, and dejection of spirits are experienced, together with the characteristic symptom of hydrophobia, — an inability to swallow fluids. The aversion to swallowing increases to such a degree that, when any liquid is brought near to the patient, he starts with dread and horror; and any attempt at swallowing is accompanied with choking and sobbing, and is often followed by convulsive paroxysms. This condition lasts for a few days, and then the patient gradually dies of exhaustion.

It is a singular feature of hydrophobia that in the majority of cases the mind of the patient is unaffected to the last, and he fully apprehends his dreadful condition through all the attendant sufferings. There has been no absolute remedy yet discovered for this disease; and the medical treatment consists merely in giving relief, which is usually done by injections, under the skin, of powerful narcotics.

When a person has been bitten by a mad dog, or even where there is only a suspicion of madness, immediate means should be used to remove the poison from the wound. If the bite be on a leg or arm, a handkerchief or piece of rope should be at once tied tightly around the limb above the wound. The wound should be sucked, if practicable, and afterwards be cauterized with nitrate of silver, or with a red-hot poker or knife. (Other remedies are given under "Poisonous Bites.")

A recent French investigator has announced the discovery that bichromate of potash, injected into the wound immediately after it is received, will almost invariably neutralize the action of the poison; but this has not been sufficiently demonstrated yet to warrant its being recommended as a specific.

CONVULSIONS. — *Hysterical and epileptic* convulsions are frequently met with, and resemble each other in some particulars. The following is a tabulated form showing their differences: —

Hysteria is a disease occurring nearly always in females, and is often accompanied by convulsions with partial unconciousness.	Epilepsy is a periodical disease, distinguished by the spasmodic movements of the muscles, and unconsciousness during an attack.
Cause. — Supposed to be due to some nervous irritation originating in the womb.	*Cause.* — Often hereditary. Intemperance, venereal excess, self-abuse, blows on the head, and fright are the most common exciting causes.
Symptoms. — (1.) Partial or apparent unconsciousness.	*Symptoms.* — (1.) Sudden and complete loss of consciousness.
(2.) The face may be flushed or unaltered, no froth on the lips; the eyelids are closed; the eyeballs fixed; there is neither grinding of the teeth or biting of the tongue.	(2.) The face becomes livid, frothy saliva escapes from the mouth, the eyelids are half open and the eyeballs roll, there is grinding of the teeth, and the tongue generally becomes bitten.
(3.) There is no distortion of the countenance.	(3.) The countenance becomes distorted.
(4.) The patient sigh, laughs, or sobs.	(4.) The patient is perfectly unconscious.
(5.) The patient feels a peculiar sensation some days previous to an attack, and complains of a ball-like sensation in the throat.	(5.) A peculiar sensation is often felt a few moments previous to an attack, as if a drop of cold water had run along the arm.

(6.) The convulsions are general, both sides of the body being affected.

(7.) The paroxysm may last for some time, especially if many sympathizing persons be present.

(8.) Paroxysm not followed by sleep; the patient becomes depressed in spirits, and often suffers from hallucinations.

(9.) Seldom occurs at night.

(10.) Often occurs at a stated interval of four weeks.

Treatment. — During a fit or paroxysm, nothing need be done except sprinkling a little cold water over the face. A dose of castor oil, or some other purgative, should be given as soon as the patient will swallow.

For the cure of hysteria, the general health ought to be improved by proper diet, exercise, and bathing.

Mental and emotional excitement should be avoided; but tranquil, even engrossing, occupation will be beneficial.

If the patient is in a weakly condition, tonics are called for, the best being iron, bark, or tinctures of columbo or gentian.

For the nervous condition nothing is better than valerianate of zinc pills, one or two grains three times a day. Tincture of assafœtida and guaiacum, in equal parts, — dose, teaspoonful three times a day, — is also recommended.

The bromide of potash is also used. If the bowels are constipated, an occasional dose of compound liquorice powder should be given, as it is very necessary that the bowels be kept regular.

(6.) Convulsions, often more marked on one side than the other.

(7.) The paroxysm usually of a short duration.

(8.) The paroxysm is followed by a heavy sleep, with deep and loud breathing; afterwards, headache and dulness of intellect.

(9.) Frequently met with at night.

(10.) No particular time of the month.

Treatment. — During a paroxysm, little or nothing is to be done. Place the patient so that he cannot strike his head or limbs against anything hard; loosen the clothing about the neck. A towel or piece of wood should be placed between the teeth to prevent the tongue from being bitten.

Self-management is very important to the epileptic. Temperance in all things, with *nutritious* diet and regularity of the evacuation of the bowels, is a *sine qua non.*

Abundant exercise in the open air, short of exhaustion, does good. Systematic gymnastics have even cured some cases.

Brown-Séquard's prescription for epilepsy is perhaps the best that can be used. It is composed of iodide of potash, one drachm; bromide of potash, one ounce; bromide of ammonia, two and a half drachms; bicarbonate of potash, forty grains; infusion of columbo, six ounces. Dose, a teaspoonful, with a little water, before each meal, and three teaspoonfuls at bedtime.

TETANUS, RIGID SPASM, OR LOCKED JAW. — The cause of this disease, in a great number of cases, is due to some injury to the nerves or tendons. It, however, often occurs from sudden changes in temperature, exposure to cold, united with moisture, excessive heat, irritating substances in the stomach or intestines, in affections of the brain or spinal cord, and by strychnia-poisoning.

Symptoms. — These are, a sense of stiffness in the back of the neck, rendering the motion of the head difficult and painful; difficulty in swallowing, pain often violent, referred to the chest-bone and thence shooting to the back; spasms of the muscles of the neck, pulling the head strongly backwards; rigidity of the lower jaw, which increasing, the teeth become so closely set together as not to admit of the smallest opening. If the disease proceed further, a great number of muscles become affected, as those of the spine, bending the body backwards; or the muscles of the abdomen may contract when the body is bent forwards. The stiffened parts are affected with violent contractions, which occasion the most excruciating pain. A remission usually takes place every ten or fifteen minutes; but they are renewed with aggravated torture. Towards the end, the countenance becomes livid, delirium sometimes supervenes, and the patient dies of exhaustion or suffocation.

Treatment. — It is said that, if tetanus arises from a wound, turpentine poured into the wound gives relief.

The medicines that are generally used are as follows: Opium, brandy, chloroform, curara-poison, Calabar bean, chloral hydrate, bromide of potash, etc. All these drugs, in different cases, have proved successful, and at other times have proven useless.

NEURALGIA is a pain without inflammation, — literally "nerve-pain."

Causes. — 1. It may be due to local irritation affecting a nerve, as is often seen in neuralgia of the face, from a decayed tooth.

2. Blood changes which sometimes occur during pregnancy, or proceed from malarial influences.

3. A morbid state of the nerve centre.

Neuralgia of the face is also called *tic-douloureux;* of the hip and thigh, *sciatica;* in the stomach, *gastrodynia*, etc.

Treatment. — Application to the part of a mixture composed of equal parts of camphor and chloral hydrate; and the internal use of croton chloral, five grains, and tincture of digitalis, ten drops, every three hours, will usually suffice to give relief. Hot applications constantly to the seat of pain are also very useful.

If the neuralgic pains occur at stated intervals, and are supposed to be due to malaria, two or three grains of quinine should be taken three times a day; or Fowler's solution of arsenic, five drops, three times a day.

PLEURODYNIA, also called *intercostal rheumatism. Symptoms.* — A dull, heavy pain situated in the chest, usually on the left side, which is increased by coughing, or moving the arms. It is distinguished from pleurisy by the absence of fever. *Treatment.* — A mustard or belladonna plaster should be applied to the place where the pain is felt.

INTERCOSTAL NEURALGIA. — This is often mistaken for pleurisy by the severe pain in the side, but may be distinguished from it by its having three tender points, — one near the spine, another near the breast-bone, and the third between the other two, — and also by the absence of feverish symptoms. *Treatment.* — Rub a mixture of equal parts of chloral hydrate and camphor over the seat of pain. As in this malady the patient is usually anæmic, or deficient in blood corpuscles, ten drops of the tincture of iron, three times a day, should also be taken.

CATARRHAL FEVER, also called *influenza, la grippe*, etc.

Cause. — It is due to an epidemic or atmospheric influence.

Symptoms. — The patient complains of having taken a severe cold, but prostration comes on suddenly. He has more or less running from the nose; the eyes become red and watery; there is a slight cough and headache, sometimes extremely severe; appetite is lost; and a feeling of chilliness is experienced; this is followed by fever, after which perspiration ensues, drenching the patient. This may continue from three to six days. This disease is not dangerous, but, in the aged, pneumonia or bronchitis may supervene.

Treatment. — A warm mustard foot-bath should be taken at night; this should be followed by a large draught of hot lemonade; and next morning a dose of citrate of magnesia, or Epsom salts, should be taken. If the skin is hot and dry, a dose of sweet spirits of nitre may be added to the lemonade. In old or sickly persons, a hot whiskey punch is beneficial; or tincture of nux vomica, ten drops in a half tumbler of water three times a day. Another remedy is five drops of Fowler's solution of arsenic in a little water, three times a day; inhalation of a few drops of chloroform, or the steam from boiling water, in which ten drops of creosote have been added to the pint of water. Sometimes camphor inhaled does good; or ten drops of spirits of camphor, with twenty drops of alcohol, may be added to a pint of boiling water and the steam inhaled. Ozone has, for the past few years, been used extensively.

GLANDERS.—This is not common in the human subject, but the affection may be taken from the horse.

Symptoms.—Two or three days after being exposed to the disease, feverish symptoms appear; the nostrils become inflamed and sore; and at the same time the joints get stiff and painful, resembling rheumatism. Over the whole body, small red patches appear, which may grow dark and even gangrenous; crops of little pustules appear also on the face and limbs. In the course of a week, a thick and offensive discharge comes from the nostrils, which are by this time swollen and ulcerated. The throat becomes sore, and the eyes and face become inflamed and swollen; abscesses also form about the body. Fever continues throughout with great thirst; later on, diarrhœa and delirium may occur, with a disagreeable odor from the body. In a great majority of cases, death takes place.

Treatment.—Good nourishment should be given, with stimulants if necessary. Quinine, sulphite of sodium, or salicylate of sodium are recommended. To the nose and inflamed parts a little carbolic acid dissolved in glycerine should be applied.

DENGUE, or *break-bone* fever, also called *dandy fever.*

Cause, not known; supposed to be epidemic.

Symptoms.—Usually after a chill, fever comes on and is moderate in degree, but is attended by considerable debility and severe pain in the joints and head, the former being sometimes enlarged. By the close of the second or third day the fever abates, and the pains diminish, though they do not disappear. Towards the end of a week from the commencement of the attack, a rash breaks out, which is red and fine, like that in scarlet fever, but sometimes like measles. The fever returns often about the fourth or fifth day, and ceases as soon as the rash appears. All the symptoms subside about the beginning or middle of the second week, but the patient is usually left debilitated.

Treatment.—This disorder requires nothing more than good nursing. If the pain be severe, ten grains of Dover's powder may be given at night, and local applications of laudanum may be applied to the joints.

RHEUMATISM: *Acute or Inflammatory Rheumatism.*—This disease is due to an acid condition of the blood. Cause: Certain persons and families are liable to this disease, exposure to cold or wet being usually the exciting cause.

Symptoms.—It is characterized by high fever, with severe inflammation of several of the larger and smaller joints, which usually one after another become swollen, red, hot, tender, and painful. The disease is rarely confined to the joints first attacked, but, after continuing in them for some hours or days, it attacks fresh joints; sometimes continuing unabated in those first affected, at others leaving them quite free from pain or swelling. In rarer instances, it returns to the joints first affected, and ultimately extends to all the large joints of the body. The skin has a wax-like appearance, and is covered with a copious acid perspiration.

Treatment.—The great danger in this disease is the heart trouble it sometimes leaves behind after it has subsided. Therefore the remedies used should act promptly. The most beneficial is salicylate of soda in fifteen or twenty grain doses, every two, three, or four hours, according to the severity of the disease. This should be continued until all pain has subsided. The diet should be composed mainly of milk; buttermilk is excellent. Should the pain be extremely severe, a ten-grain dose of Dover's powder may be administered at night. All the inflamed joints should be well wrapped up in cotton-batting. The chronic pain and stiffness, which sometimes remain after the acute attack has passed off, is best treated with iodide of potash, ten grains three times a day, and friction, with some liniment applied to the joints.

Chronic Rheumatism. — Any one may suffer from this affliction, but it is most common in advanced age. The pains are apt to be worse at night, or in wet or damp weather.

Treatment. — Turkish baths seem very successful in this disease. Local applications to the joints of some stimulating liniment, such as camphor or soap liniment; electricity, and blisters applied near the joint, are often serviceable. Of internal remedies, many are recommended, but the one which seems to give the most relief is a mixture composed of potash carbonate and potash iodide, each two drachms; wine of colchicum, half an ounce; glycerine and water, each one ounce: a teaspoonful of this should be taken three times a day. Those who suffer from rhematism should constantly wear flannel underclothing.

Remittent Fever (*called also Bilious Fever*). — The origin of this fever is undoubtedly due to the entrance into the body of minute vegetable organisms. These are strictly localized, and, in thickly built portions of cities, never arise: it is only near marshes, shallow lakes, and slow streams, or new-made or cultivated soil, that they seem to vegetate.

The first symptoms noticed are those of *malaise*, with headache, furred tongue, etc. These symptoms have but a short duration. The fever is usually ushered in with a chill, sometimes severe, at other times mild, and lasting for an hour or more; vomiting at this time may occur. As soon as the febrile condition is developed, the skin becomes dry and hot, the pulse rising in force and frequency. The face becomes flushed, the head throbbing, with violent pain in the back. Vomiting now commences, the vomited matters being green and bitter to the taste. Thirst is great, with loss of all appetite. The bowels are costive. This condition continues for from six to eighteen hours; the patient becomes then more comfortable, and usually falls into a sleep. When he awakes the skin is moist, the headache and pain in the back less severe; the stomach also becomes less disturbed. After remaining in this condition from six to twenty-four hours, all the severe symptoms again return; the skin becoming hotter than before, the cheeks flushed, intense thirst, nausea, and disgust for all food. The tongue becomes thickly coated, and the urine dark-colored and scanty. Vomiting, in a majority of cases, returns, the stomach rejecting everything, even cold water. The condition again becomes relieved, and these remittent attacks continue from seven to fourteen days. In the majority of cases, recovery takes place.

Treatment. — The first thing to be done is to give a purgative of calomel, ten grains, with twenty grains of bicarbonate of soda, or three compound cathartic pills. If the headache be severe, some cooling lotion to the head may be applied. Bay-rum is excellent for this. Thirst may be relieved by sucking little lumps of ice, and this will also relieve vomiting. If the vomiting be very distressing, a mustard poultice should be placed over the pit of the stomach, and one drop of ipecac wine be given every ten minutes, or ten grains of bismuth subcarb. As soon as the fever abates, a ten-grain dose of quinine should be given, and repeated every second hour, until three doses have been administered. The same amount should be taken every day, until a cure is effected. Should the stomach refuse all substances in the way of food as well as medicine, they should be injected into the lower bowel; but, in that case, fifteen grains should be used, instead of ten grains of the quinine. The best way to take the quinine is in capsules, or mixed with syrup of orange-peel.

INTERMITTENT FEVER, called also *ague, chills and fever.* The origin of this is the same as remittent fever, and it is supposed, when only a small quantity of these organisms enter the system, they produce intermittent fever.

Varieties. — When the paroxysms occur every day, it is termed *quotidian;* when it is every other day, *tertian*, etc.

Symptoms are divided into three distinct stages, — 1st, the cold stage or chill; 2d, the hot stage; 3d, sweating stage.

The cold stage begins with languor and yawning; a sense of coldness comes on, increasing until the whole body shivers and the teeth chatter; the lips and finger-ends turn blue; thirst exists, with loss of appetite, and sometimes vomiting; a large quantity of colorless urine is passed. This lasts from ten minutes to two hours, and passes into the second or hot stage, when a gradual warmth is felt to return; the cheeks become flushed, tongue furred, skin hot, severe headache, and intense thirst. The urine passed now is dark-colored and scanty. During this stage vomiting occurs frequently in some cases. This condition continues from one to sixteen hours, and gradually gives place to the sweating stage. The face first becomes moist, and afterwards the trunk and limbs. This is attended with a feeling of great comfort; the headache lessens and the vomiting ceases; and the patient falls into a sleep and perspires profusely. After this the fever disappears, and the urine passed deposits a sediment like brickdust.

The patient now feels comparatively well, but the symptoms again become developed either on the next day or the day after, according to the variety; and the chill usually commences at the same hour, and the disease goes through its three stages. Sometimes one of the stages may be wanting, or a paroxysm of pain may occur on regular days, known as "brow ague." When this chill is absent it is often called "dumb ague." Sometimes there are two attacks in one day, when it is called double quotidian, double tertian, etc.

Treatment. — It is good treatment to begin with a purgative, and the same may be taken as recommended in remittent fever. As soon as the sweating stage has begun, fifteen grains of quinine sulphate should be administered, in divided doses (five grains), between the sweating stage and the commencement of the next chill. During the cold stage, a warm drink is often a relief, but it should contain no stimulants. During the hot stage, cooling drinks may be used without harm.

TYPHUS AND TYPHOID FEVERS are somewhat similar to a casual observer; but, as typhus fever is very contagious, we have placed the two in a tabulated form, so that their symptoms may be more readily distinguished, and precautions taken accordingly: —

TYPHOID, also called slow nervous fever; common continued, enteric fever; gastric fever.	TYPHUS, also called ship-fever; camp-fever, jail-fever.
(1.) Age generally from 18 to 35 years.	(1.) May occur at any age.
(2.) Is not contagious, but often epidemic.	(2.) Is very contagious.
(3.) Occurs as frequently among the rich as among the poor.	(3.) Occurs chiefly amongst the poor.
(4.) Decomposing vegetable or animal matter, imperfect sewerage, or foul gases are often the cause.	(4.) Cause depends no doubt on the effluvia from human bodies, accumulated, especially in cold weather, in small and ill-built dwellings of the poor, or wherever there are a number of persons crowded together.
(5.) Begins insidiously with a feeling of malaise, headache, and loss of appetite, which continues for several days; bleeding from the nose and	(5.) Begins usually with a chill and violent headache, loss of appetite, thirst, and delirium or stupor. There is no bleeding from the nose or

a slight cough may also occur. After some days, the patient takes to bed with severe fever. The face has a purplish flush, and the pupils of the eyes are dilated.	cough. The skin becomes very dry and hot, and the whole face has a red flush. The eyes are bloodshot and the pupils contracted.
(6.) Delirium comes on about the end of the first week, and is especially prominent at night; voice is low and muttering.	(6.) Delirium comes on early in the disease, and is often of a violent character.
(7.) The patient does not complain of much headache after the first few days.	(7.) The patient, if not too delirious, complains of severe headache.
Muscular debility not very great.	Muscular debility very great.
(8.) Diarrhœa occurs early, and the passage has the appearance of "pea-soup."	(8.) Usually the bowels are costive; but, if any diarrhœa, the passage is dark in appearance.
(9.) About the end of the first week, the abdomen becomes enlarged and drum-like.	(9.) The abdomen becomes contracted, except in very unusual cases.
(10.) Pressure over the lower part of the abdomen or the right side produces pain.	(10.) Pressure over the abdomen produces no pain.
(11.) Little rose-colored spots appear over the abdomen about the fifth or seventh day, which disappear on pressure, and return as soon as the pressure is removed.	(11.) Dark-colored spots appear over the abdomen and limbs, which on pressure do not entirely disappear. A peculiar odor is also emitted from the body.
(12.) Pulse very rapid and soft.	(12.) Pulse rapid and bounding.
(13.) Temperature increases every evening one degree, until it reaches 104° or 105° or more.	(13.) Temperature increases rapidly, and may go up to 106° or 107°.
(14.) Tongue becomes at first coated, and about the middle of the second week becomes dry and cracked.	(14.) Tongue soon becomes dry and cracked, and has also a dark color.
(15.) Vomiting rarely occurs.	(15.) Vomiting is of a more frequent occurrence.
(16.) Bleeding from the bowels frequent.	(16.) Bleeding from the bowels never occurs.
(17.) Fever lasts for about 21 days, and the patient becomes greatly emaciated.	(17.) Fever lasts for 14 days, and the patient does not become emaciated.
(18.) Death rarely results before the end of the second week.	(18.) Death frequently results at the end of the first week.
Treatment.—The patient should be placed in a large, well-ventilated room. The diet should be of the best and in a concentrated form, but no solids. Stimulants are called for when the tongue becomes dry; and the body should occasionally be sponged with whiskey and water. Ten drops of dilute nitro-muriatic acid with one grain of quinine every four hours. If fever runs very high, 20 grains of quinine should be administered in one dose. If diarrhœa be excessive, or bleeding from the bowels occur, the treatment should be the same as given under those heads. (See "Diarrhœa" and "Bleeding from the Bowels.") When the patient becomes very weak, a teaspoonful of tincture of capsicum may be given every four hours with whiskey and glycerine. During convalescence tonics are required, and the diet should be of a liquid form for some time.	*Treatment.*—Good ventilation, with good hygienic surroundings. The diet should be of the very best quality. Stimulants are required, the amount depending upon their good results. Dilute sulphuric acid, or dilute nitro-muriatic acid, ten drops each, every four hours. The body should be frequently sponged. If there be severe pain in the head, ice may be applied for a short while to the head. Should the delirium be very violent, five drops of laudanum may be given every four hours. The bowels should be kept open by some gentle laxative. During convalescence, tonics and good diet are required.

CATARRH, also called *June cold*, *hay-fever*, *summer or autumnal catarrh*.

Cause not perfectly known, but is supposed to be due to some peculiar source of irritation in new-mown hay, roses, etc.

Symptoms. — When first perceived, it appears as a slight itching in the palate and roof of the mouth, and this is soon followed by a similiar sensation extending from the throat into the ears. This induces the sufferer to attempt relief by constantly swallowing and rubbing the tongue against the roof of the mouth, and pressing and rubbing about the ear. •Usually there is headache, which is often severe, with redness of the eyes, sneezing, irritation of the nose and back of the throat, which induces a dry and harassing cough. Attacks of asthma may also occur, lasting for three or four hours at a time. The first attack of hay-fever is generally milder, and less persistent, than subsequent ones. It often lasts from three to six weeks, or even longer. It is a curious circumstance that hay-fever is almost exclusively confined to the educated classes.

Treatment. — Avoid everything which seems to excite it. A trip to the seaside is often the means of preventing an attack at the expected time.

TRICHINOSIS. — This disease is due to the entrance in the human body of a small worm, known under the name of *trichina spiralis*. This parasite is found in many diseased meats, but more especially in pork.

Symptoms. — The disease produced by them has two distinct stages, —

1. The entrance of the worms into the stomach and intestines, and their multiplication there.
2. That of their migration to, and location in, the muscles.

The first period or stage lasts about a week. There are symptoms of cholera morbus, after which the patient suffers from fever resembling typhoid, with severe pains, stiffness in the muscles, and prostration. The muscles of the larynx are often affected, giving rise to hoarseness. This stage may terminate fatally within six days, but usually has a duration of from two to five weeks.

Treatment. — This, so far, has not been very successful, but recoveries have been reported under the use of friction of the limbs with bay-salt. Carbolic acid or turpentine are recommended for internal use. Prevention is always possible by cooking the meat thoroughly.

NIGHT-SWEATS. — These are always the result of great debility, and are most often complained of in consumption; but any disease that induces a low state of the health promotes them.

Treatment. — Aromatic sulphuric acid, ten or fifteen drops well diluted with water, at bedtime, will usually check it. So also will sponging the body with vinegar and water, or one-quarter-grain doses of the extract of belladonna.

DISEASES OF THE MOUTH AND TONGUE. — *Simple stomatitis*, or inflammation of the tongue and cheeks.

The cause of this trouble is usually the result of taking hot or corrosive liquids into the mouth.

Symptoms. — These are, redness and swelling of the tongue, the gums, and the lining membrane of the cheeks, etc. The course of this disease is generally simple and brief; but when the tongue becomes much inflamed (glossitis), it is more serious.

Treatment. — Holding pieces of ice in the mouth, or washing the mouth out frequently with flaxseed tea or equal parts of glycerine and water, often suffices. In cases where the tongue becomes much enlarged, the application of leeches, or making incisions with a sharp knife, have been used. As soon as the swelling subsides, a solution of alum, two drachms to six ounces of water, or sulphate of zinc, one grain to three ounces of water, should be used to rinse the mouth; but care should be taken in their use, as these remedies often injure the teeth if allowed to remain too long in contact with them.

Nurses' Sore Mouth. — Women who nurse children, or those advanced in pregnancy, are liable to suffer from ulcerations of the mouth. They begin as small, hard, and painful swellings on the tongue or cheeks, which ulcerate, and may be attended with a great deal of pain and fever.

Treatment. — Twenty grains of chlorate of potash should be taken three or four times a day. If the patient be debilitated, iron, quinine, and good diet are recommended. The ulcers should be touched with solid bluestone twice a day; and afterwards chalk and gum-arabic, in equal parts, should be dusted over them. Occasionally washing the mouth with flaxseed tea, or glycerine and water, will assist in giving relief.

CANCRUM ORIS, or canker of the mouth, begins as small ulcers on the cheeks, gums, or lining of the lips. The ulcer is usually grayish or yellowish-white, with an inflamed and ragged border. A large amount of saliva is poured into the mouth, and the cheeks sometimes swell externally.

Treatment. — Same as for nurses' sore mouth.

PHARYNGITIS, or sore throat, is usually the result of a slight cold. The chief symptoms are heat and dryness in the throat, and acute pain in swallowing. There is a constant desire to cough without anything being hawked up. The symptoms are usually increased towards night.

Treatment. — Some simple gargle (as Receipts 25 or 26) should be used. If the palate be elongated, some astringent, such as alum, may be mixed with the gargle. In cases where the disease becomes chronic and the throat becomes granulated, a stronger astringent is required, such as nitrate of silver, or tannic acid, ten grains of either in water, applied twice a day to the throat with a camel's-hair pencil.

ULCERATED SORE THROAT. — The throat often becomes ulcerated from a simple cold, but it is frequently found in those suffering from syphilis or consumption.

Treatment. — Those arising from simple cold are usually cured by the application of lunar caustic (nitrate of silver) or bluestone to the ulcers; they should be touched lightly, and afterwards some simple gargle, as flaxseed, be used. Syphylitic or tuberculous ulcerations require, besides local applications, the internal administration of medicines used in those diseases.

TONSILITIS, when severe, is commonly called *quinsy.* It is due to inflammation of the tonsilis.

Cause. — Some persons are particularly liable to this disease, and exposure is usually the exciting cause.

Symptoms. — Soreness of the throat and difficulty in swallowing are the early symptoms; in more aggravated cases, the tonsils become greatly enlarged; great difficulty is experienced in swallowing, with severe pain, and the pain seems to run into the ear; the voice becomes guttural. Severe fever usually accompanies this disorder, with headache, constipation, etc. If an abscess forms, the pain becomes constant and throbbing.

Treatment. — A dose of the citrate of magnesia should be taken on the first day. This should be followed by one fifteenth of a grain of gray powder every hour, until twelve or fifteen doses have been taken. A warm flaxseed poultice should be applied to the throat.

This treatment has often the effect of preventing the formation of pus. Inhalation of steam also relieves the pain. If an abscess forms, it should be opened by a surgeon. The throat should be constantly gargled with slippery-elm or flaxseed tea.

CHRONIC ENLARGEMENT OF THE TONSILS should be touched daily with a strong solution of nitrate of silver, or tannic acid. By a surgical operation, a small piece of the tonsil may be removed: this will produce contraction of the tonsils, and afford relief from subsequent trouble. Painting the throat with iodine, or applying a small blister, is also recommended.

LARYNGITIS is a slight inflammation of the membrane lining the *larynx.* It is very common as the result of a cold. Its symptoms are hoarseness, with a dry, harsh cough, accompained with soreness in drawing the breath.

Treatment. — Some simple gargle, as sage or flaxseed tea. If the bowels are costive, a dose of citrate of magnesia should be taken. Some hot drink taken before retiring, which will produce a sweat, usually suffices for a cure.

CHRONIC LARYNGITIS, or *Clergyman's Sore Throat* as it is commonly called, is the result of speaking or singing a great deal. It is best treated by a spray apparatus, the liquid used being two or three grains of nitrate of silver to an ounce of water; the throat should be sprayed with this once or twice a day. Sucking small pieces of borax of about the size of a pea in the mouth, two or three times a day, is also recommended.

The following four principal diseases of the chest have been placed in a tabulated form, so that the differences between them may be readily seen: —

PNEUMONIA, OR INFLAMMATION OF THE LUNG SUBSTANCE.	PLEURISY, OR INFLAMMATION OF THE MEMBRANE COVERING THE LUNG.
Cause. — It sometimes follows exposure to cold and wet; or may occur during low fevers, or consumption.	*Cause.* — It sometimes follows exposure to cold and wet, or may occur during rheumatic fever, and also may result from an injury to the side.
Symptoms. — (1.) May occur at any age, but usually in middle life.	*Symptoms.* — (1.) May occur at any age, but generally in middle life.
(2.) Usually commences with severe chills, headache, loss of appetite, great thirst, and the tongue is coated.	(2.) Usually commences with slight chill, loss of appetite, sometimes headache and thirst, and the tongue is coated.
(3.) Cheeks become flushed; skin dry and very hot; pulse strong, full, and rapid.	(3.) Cheeks, as a rule, do not become flushed; skin moist and not very hot; pulse rapid and full.
(4.) Pain generally on the right side of the chest, of a dull, heavy character.	(4.) Pain extremely severe, of a sharp, stabbing character, situated immediately under the nipple, usually on the left side.
(5.) Number of respirations per minute greatly increased.	(5.) Number of respirations increased, and the abdomen moves more than the chest.
(6.) Cough very troublesome.	(6.) Cough slight, sometimes none at all.
(7.) Expectoration thick, and difficult to get up, which, after the second or third day, becomes bloody and looks like iron-rust.	(7.) Expectoration of a little frothy mucus, which does not change its color.
(8.) Bowels usually constipated; urine dark-colored and scanty.	(8.) Bowels generally constipated; urine dark-colored and scanty.
(9.) Improvement takes place on the fifth,	(9.) Improvement as regards pain usually

seventh, or ninth day. The skin becomes moist and the respirations less frequent.

(10.) Usually terminates favorably if only one lung has been affected, but death may result.

(11.) There is no change in the form of the chest observable.

Treatment. — A purgative should be administered, either Epsom or Rochelle salts. The chest should be dry-cupped, after which it should be covered with oilskin, or a warm poultice of flaxseed. When there is a full pulse and dry skin, a mixture composed of one drop of the tincture of aconite, fifteen drops of sweet spirits of nitre, and two drachms of the solution of ammonia acetate, should be administered. The diet should be light, and in weakly persons stimulants should also be given. After recovery, flannel sshould be worn for some time.

ACUTE BRONCHITIS, OR INFLAMMATION OF THE MUCOUS MEMBRANE OF THE BRONCHIAL TUBES.

Cause. — Usually results from exposure to cold or wet.

Symptoms. — (1.) May occur at any age, but usually in the young or old.

(2.) Begins with symptoms of a severe cold, running from the nose, loss of appetite, furred tongue, constipation, sensation of tickling in the throat.

(3.) Cheeks do not become flushed, nor is the skin particularly hot; pulse-beats increased in number.

(4.) Pain is felt under the breast-bone and between the shoulders.

(5.) Cough occurs in paroxysms, and produces a feeling of rawness in the chest; at first it is dry and tight.

(6.) Respirations difficult and increased in number, associated with a feeling of oppression in the chest.

takes place after the first or second day; but difficulty in breathing if effusion has taken place, and it may be some weeks before the fluid is absorbed.

(10.) Usually terminates favorably, except both sides of the chest have been affected.

(11.) When effusion has occurred, a bulging of the affected side is noticed.

Treatment. — Strapping the side, as is done in fracture of the ribs, or the application of a hot poultice to the side, will give relief. The bowels should be purged with a good dose of Epsom salts. If the fever is high, use the same mixture as in pneumonia. One grain of opium will relieve the pain; and, after the pain has subsided, a mixture of twenty grains of the acetate of potash, and two drachms of the infusion of digitalis, should be given every six hours. Later on, the side should be painted with iodine. The diet should be light and nourishing.

PHTHISIS, OR CONSUMPTION

Is a gradual breaking-down of the lung.

Cause. — Usually hereditary, and has no acute beginning.*

Symptoms. — (1.) Generally begins between the ages of eighteen and twenty-five years.

(2.) Commences insidiously with impaired appetite, constant hacking cough, gradual loss of flesh and strength.

(3.) Cheeks become flushed during the afternoon, and the eyes bright; skin warm towards evening, especially hands and feet; the pulse is more rapid than in health; and the patient suffers from disagreeable night-sweats.

(4.) Pain, when it occurs, is situated under the collar-bone, and seems to run in the direction of the shoulder or back.

(5.) Cough troublesome, especially during the night.

(6.) Respirations quickened, especially during exertion.

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* Within the last few months Dr. Koch, of Berlin, has made known the results of his investigations of the etiology or cause of consumption. The disease, by his discoveries, seems to be due to a parasite, which he calls “bacillé.” If this, after further investigation, should be found correct and become a fact, there is good hope that the disease will be more under the influence of medical treatment than it has proved to be in the majority of cases in the past. Inoculation with this parasite has been advocated to prevent the development of the disease in after-life, with the hope that it will have a similar effect to vaccination over smallpox. This, however, will seldom be put into general practice, for the latter disease is of an acute nature, which after a time passes off; while consumption is a chronic affection, often lasting for years.

(7.) Expectoration for the first day or two is thick and difficult to get up, and it may be streaked with blood; afterwards it becomes looser and more abundant.

(8.) Bowels usually constipated.

(9.) Generally lasts for four or five days, but may continue for some time, becoming chronic.

(10.) There is no change in the chest observable.

Treatment. — A purgative of Epsom salts should be administered, and a warm flaxseed poultice applied over the whole chest. Ten grains of Dover's powder should be given at bedtime on the first night of the attack; or, if the attack be very severe, a tablespoonful of the following mixture should be administered every three hours: —

Sweet spirits of nitre, four drachms; solution of the acetate of ammonia, one ounce and a half; ipecac wine, two drachms; paregoric, four drachms; glycerine, two ounces; camphor water, enough to make eight ounces.

During convalescence, tonics should be used.

(7.) Expectoration, at first, is nothing but a little frothy mucus; afterwards becomes thick, resembling pus. Bleeding from the lungs often occurs.

(8.) Bowels constipated at first; later on in the disease, diarrhœa.

(9.) The patient usually continues to get worse, the disease lasting from eighteen to twenty-four months before death ensues; but it may continue for years.

(10.) The chest becomes contracted (this is especially noticeable under the collar-bone), and the shoulders become lifted.

Treatment.— Hygienic management is far more important to consumptives than medicine, and the following precepts are well laid down by Dr. B. W. Richardson: —

1. A supply of fresh and pure air for respiration is constantly required.
2. Daily exercise in the open air is imperatively demanded.
3. It is important to secure for the patient a uniform, sheltered temperature, and mild climate to live in, with a temperature about 60° and a range of not more than 10° or 15°.
4. The dress of the consumptive patient ought to be of such a kind as to equalize and retain the temperature of the body.
5. The hours of rest should extend from sunset to sunrise.
6. In-door or sedentary occupations must be suspended; but out-door employment in the fresh air, even in the midst of snow, has been, and may be, advantageous.
7. Cleanliness of the body is a special point to be attended to in the hygienic treatment of consumption. The medicines that are recommended are numerous, but nothing, so far, has been found to act as a specific. Cod-liver oil, or arsenic, has been used for years; and lately the hypophosphites have been brought into use, and have certainly proved, in some cases, very efficacious. Malt extracts, by improving the digestion and system in general, have a tendency to assist in the arrest of the disease.

CHRONIC BRONCHITIS. — This usually is an affection of old age, and is the result sometimes of one acute attack, but, in the majority of cases, after several repeated attacks of acute bronchitis. Its most troublesome time is during the winter months. The cough comes on in paroxysms, and is generally most severe on getting out of bed in the morning. The expectoration is usually copious, and is either thick and heavy or thin and watery. The general health does not seem to suffer, nor is it dangerous to life.

Treatment. — The use of ipecac wine, diluted with twice its quantity of water in the form of a spray, thrown by an apparatus which may be got at any instrument-maker's ("Richardson's" is the one most commonly used), is very efficacious; also rubbing the chest with equal parts of croton and sweet oil, about six drops of the mixture, every night, until an eruption occurs. The following mixture also is useful: —

℞ Balsam of copaiba, three drachms; compound spirits of lavender, three drachms; glycerine, one ounce; water, enough to make six ounces. Dose, tablespoonful three times a day.

Every means conducive to health should be used, and tonics of tincture of cinchona, or iron, etc., will assist in a cure.

ASTHMA, OR SPASM OF THE BRONCHIAL TUBES. — Every night, or once a week, month, or year, or at irregular intervals, the attack comes on; most frequently it is between one and three o'clock in the morning. Before its occurrence, there are usually some symptoms, such as great drowsiness in some cases, or wakefulness in others; headache, flatulence, or itching under the chin. When it occurs, there is great difficulty in breathing; the sufferer sits up and leans forward; a wheezing sound accompanies respiration; and the skin becomes covered with perspiration. The attack may last only a few minutes, or may continue for hours, or even days. Death seldom occurs from asthma alone.

Treatment. — During the attack, our aim should be to give relief. Ipecac wine, tincture of lobelia, and Hoffman's anodyne, twenty drops each, should be given every half-hour, until nausea or expectoration is produced. A cup of hot black coffee often gives relief. The iodide of potash, ten grains three times a day, is the latest remedy. During the paroxysm, cupping the chest, or applying a mustard poultice, assists in giving relief. In hay-asthma, great benefit is often obtained by applying to the nostrils, and snifling up into the nose, a saturated solution of quinine sulphate.

DISEASES OF THE HEART. — The principal causes of heart disease are rheumatic fever and kidney disease. The varieties are numerous and perfectly distinct; but they can be distinguished only by an examination of the chest by a medical man. Palpitation is one of the most prominent symptoms, but it may arise from other causes than organic disease.

1st. Nervous palpitation occurs in debilitated persons, especially hysterical females, and frequently comes on during the night. It also occurs in persons who use coffee, tea, tobacco, and stimulants to excess. It is not increased during exercise.

2d. Dyspeptic palpitation arises from indigestion, and is worse after meals.

3d. Gouty and rheumatic palpitations occur in those subject to these diseases.

True or organic disease of the heart is usually slow in its progress. Among its most prominent symptoms are, pain in the chest, palpitation, blueness of the face and lips, some difficulty in breathing, irregular pulse, cough, distressing dreams, dropsy, etc.; most of these symptoms being increased by exercise.

Treatment. — The treatment depends upon the cause; and, as it is impossible for us in these few pages to go into the symptoms of each, we would advise the examination of the chest by a physician. We might, however, say that nervous, dyspeptic, gouty, or rheumatic persons should be treated in accordance with those diseases; while organic diseases, more especially, require avoidance from all excitement, mental or physical, and the discontinuance of the use of tobacco, stimulants, tea, and coffee. Tonics are advised, the best being iron, nux vomica, digitalis as a heart tonic, etc.

FATTY DEGENERATION OF THE HEART. — This is the substitution of fatty substance for the muscular tissue of the heart. This disease is always gradual in its progress, and fails to make itself known until a late period: the subject of it is usually corpulent, and advanced in life. The symptoms are usually feeble circulation, coldness of the extremities, exhaustion, and difficulty of breathing on exertion. At a later stage of the disease, attacks resembling those of apoplexy occur. The crystalline lens of the eyes also becomes fatty, and the sight of one or both eyes may be destroyed. The first of these attacks may prove fatal, but they often continue for years without terminating fatally.

Treatment. — There is no cure for this disease, but life may be prolonged by tonics, particularly iron, and generous diet. Violent effort, anxiety, or excitement of any kind should be avoided.

ANGINA PECTORIS, OR SPASMS OF THE HEART. — This is usually connected with a valvular disease of the heart, but may be the result of the blocking-up of the coronary arteries. The spasm usually occurs when in the act of walking: there is a severe pain in the region of the heart, extending along the left arm, with a sense of oppression in the chest, prostration and a sense of alarm. The attack may last for only a few minutes, or may continue for several hours. As soon as the attack passes over, perspiration and copious urination ensue. Death seldom occurs from the first attack, and the subject of the disease may live for many years.

Treatment. — There is no certain cure for this disease, but five drops of Fowler's solution of arsenic, three times a day, has been recommended by Philipp. During the attack, mustard plasters should be applied over the chest and between the shoulders, and one drachm of Hoffman's anodyne in water, administered. Nitrate of amyl is the most valuable remedy yet discovered, but should be administered only by a physician.

FAINTING, OR SYNCOPE, is due to the sudden failure of the heart's action. Its occurrence is favored by general debility, especially in anæmic or thin-blooded persons. It is most commonly met with in young ladies who spend a greater portion of the day on the sofa reading novels. Want of occupation is one of the predisposing causes. Hot and ill-ventilated rooms also are often the exciting cause.

Symptoms. — A person about to be attacked with syncope experiences an indescribable distress, or feeling of faintness; the eyes become dim and covered with a kind of film; there is a sense of singing or buzzing in the ears; the countenance and lips become pale; the mind fails, and the body is covered with a cold prespiration; and the patient, if unsupported, falls to the ground. A recovery is announced by deep and heavy sighs, and in some cases vomiting occurs.

Treatment.— If the patient has fallen to the floor, you should leave her in that position, and on no account raise the head. If she has fallen backward on a chair, bend the body forward so that the head will nearly touch the knees. A little water sprinkled on the face, and exposure to the cool air, soon bring the patient around. A little ammonia or smelling-salts should be applied to the nostrils; and, if the patient can swallow, a little ammonia in water, or other stimulants, may be given. Those subject to fainting-fits require tonics, outdoor exercise, attention to the bowels, and avoidance from excitement.

PLETHORA, *Fulness of Blood.*

Cause. — Excessive use of animal food, rich articles of diet, etc.

Symptoms. — General aspect of body full and florid. The skin becomes congested and red; pulse full and bounding, sometimes irregular in force and frequency; tongue clean and red, or slightly furred; appetite good, or, in extreme cases, variable; bowels generally confined; skin dry; extremities generally cold; palpitation and difficulty of breathing on exertion; frequent sighing; dull, heavy pain in the head; listlessness; debility.

Treatment. —The diet should be chiefly of vegetables; all animal or fatty matters should be avoided, or taken in very small quantities. Turkish baths and active purgation will soon reduce the quantity of blood.

ANÆMIA, OR BLOODLESSNESS. — *Cause*, loss of blood, excessive discharge of any kind, prolonged lactation, scanty food, etc.

Symptoms. — Universal pallor of skin, gums, and lining membrane of the mouth; dead-whiteness of the substance of the tongue; cold extremities; debility; palpitation of the heart and difficulty of breathing on slight exertion; fainting fits; headache, consisting generally in a fixed pain oxer the eyebrows, or on top of the head; pulse frequent, small, and quick, easily accelerated; the patient is easily agitated, and suffers from depression of spirits; the skin is usually dry, and bowels constipated.

Treatment. — Good diet, pure air, iron, and cod-liver oil are the principal remedies. Iron may be taken, in the form of the tincture, ten drops three times a day, mixed with a little glycerine and water; or phosphate of iron, in five-grain doses; or a pill composed of quinine sulphate, one grain; sulphate of iron, two grains; extract of nux vomica, quarter of a grain. Hypophosphites of iron, in ten or twenty grain doses, etc., are also recommended.

CHLOROSIS, OR GREEN-SICKNESS. — This occurs in girls about the age of puberty.

Cause. — Debility of the constitution in general and the uterine system in particular; excessive loss of blood; mental anxiety and disappointment.

Symptoms. — Listlessness; heaviness; fatigue on the least exercise; pains in the back, loins, and hips; flatulency and acidity of the stomach and bowels, and symptoms of dyspepsia; the appetite becomes depraved: lime-chalk, slate-pencils, etc., are greedily eaten, while the accustomed food is rejected. As the disease advances, the lips lose their color; the eyes are encircled by a dark ring; the face becomes pale, and assumes a yellowish hue. There is every indication of want of power and energy in the constitution. The feet and ankles become swollen; and the breathing is hurried on the slightest exertion. The patient is affected with various symptoms of hysteria, cough, etc., and, in some cases, a daily or hectic flush.

Treatment. — Good diet, sea-bathing, change of air, light gymnastics, and the same medicines as recommended for anæmia. Manganese, phosphate, or hypophosphite, in ten or twenty grain doses, are recommended when iron disagrees.

DROPSICAL AFFECTIONS. — Dropsy is considered by medical men rather as a symptom than a disease. It consists essentially of an accumulation of fluid under the skin, or in the cavities of the body. Its causes are, — I. Obstruction in the return of the blood to the heart; II. Arrest of secretions and absorptions; III. Excess of water in the blood.

Diseases of the heart and liver bring on dropsy by obstructing the passage of the blood. Diseases of the kidneys, or the action of cold upon the skin, may induce dropsy by checking the excretions from the skin and kidneys. All wasting diseases also are apt to produce this disease on account of the watery condition of the blood.

Acute General Dropsy may result from exposure to cold or wet, or from the poison of scarlet fever. This usually shows itself in the legs, but in some cases the fluid accumulates in the abdomen, chest, or even the head. Accumulation of fluid in the abdomen frequently results in scirrhosis of the liver.

Dropsy produced by disease of the kidneys usually appears first about the eyes and face; this is especially noticeable in the morning. That which is due to the poverty of the blood makes its appearance first about the ankles.

Treatment. — Acute general dropsy is best treated by active purgation: ten grains of jalap and two drachms of cream of tartar should be taken every other day. The kidneys should be acted on at the same time by an infusion of juniper berries. Half a drachm of the fluid extract of jaborandi at night produces a copious perspiration, which will assist in diminishing the accumulation of fluid.

Dropsy occurring in kidney or liver diseases will be treated under those heads (q. v.).

Dropsy resulting from heart disease requires the same treatment as above. In debility of the blood, tonics are required, and a bandage should be carefully applied to the lower limbs. When the lower limbs become greatly swollen, the skin should be punctured in numerous places, so as to permit the fluid to drain off, and thus to prevent bursting of the skin.

GOUT is a constitutional disorder, more or less persistent, which induces a local inflammation, usually in the joint of the great toe.

Cause. — Often hereditary. The adult age, especially the middle period of life; indulgence in the use of animal food and fermented liquors: sendentary and studious life, seem to predispose to it.

Symptoms. — Dyspepsia, with its usual attendants; lassitude, torpor, and dejection of spirits; unusual coldness and numbness of the extremities, alternating with a sense of pricking; frequent cramps; unusual fulness of the veins of the leg usually occurs before a paroxysm supervenes. The paroxysm most frequently comes on about two o'clock in the morning, with excruciating pain in the articulations of the great toe, succeeded by a chill and fever. The pain continues to increase in violence, and, having obtained its acme towards the following evening, ceases gradually. The skin now becomes moist, and the patient falls into a sound sleep. For several evenings the pain and fever may return, but are usually less violent.

Treatment. — During the attack, colchicum and alkalies are the remedies: fifteen drops of the wine of colchicum should be taken, with ten to twenty grains of the carbonate of potash. This should be given three times a day. Citrate of lithia is also recommended. Warm applications should be applied to the inflamed joint, and on no account should anything cold be used, as it may drive the inflammation to the stomach or heart.

ERYSIPELAS, OR ST. ANTHONY'S FIRE, as it is sometimes called, is an inflammation of the skin or its adjacent tissues. There are two varieties of this disease usually recognized, — that which arises from constitutional causes, called "idiopathic" erysipelas; and "traumatic" erysipelas, which follows a wound or injury to any part of the body. Certain individuals, and even certain families, appear to be peculiarly liable to this disease; but it is impossible to state in what this special susceptibility consists. It is said that full-blooded persons are more liable to it than others.

"Idiopathic" erysipelas usually begins with slight chills, which are followed by a fever, often severe. An eruption appears — usually on the face — in the shape of a red blotch, which spreads slowly in all directions; and this is the distinctive feature in erysipelas. This eruption is accompanied with a burning and stinging sensation, and there is also considerable swelling of the inflamed parts; sometimes little watery blisters also appear on the surface of the skin. Should the disease attack the scalp, delirium, or even inflammation of the brain, may ensue, which may have a fatal termination.

Treatment. — It is best to begin with a dose of Epsom or Rochelle salts, and this should be followed by tincture of iron, commencing with twenty and increasing to forty drops, three or four times a day. However, should the iron produce vomiting, the dose will have to be decreased. An external application should be made of an ointment composed of one drachm of sulphate of iron to an ounce of vaseline, which should be well rubbed into and around the inflamed parts. While the disorder lasts, a plain milk diet will be most suitable; and, if the patient has been accustomed to using alcoholic drinks, it will perhaps be well to continue to administer it in small doses.

In "traumatic" erysipelas the inflammation spreads from the wound, and its treatment is similar to that of idiopathic erysipelas.

Particular care should be taken, by those attending on persons suffering from erysipelas, to wash their hands after coming into contact with the inflamed parts, as the disease is sometimes contagious.

Symptoms of Indigestion.

1. A feeling of weight and fulness about the stomach, or region of the liver.
2. A distension of the stomach and bowels by air.
3. Heartburn and acid eructations.
4. A feeling of oppression and weariness; aching pain in the limbs; great sleepiness, especially after meals.
5. Tongue becomes furred, with a clammy, bitter taste in the mouth, especially in the morning.
6. Appetite often good, but at times disgust for food and nausea are felt, often in the morning.
7. Excessive secretion of thick mucus at the back of the throat and nose.
8. Constipation usually is present, but diarrhœa may occur at times. The substances passed are either too dark or too light.
9. Palpitation of the heart often occurs, especially after meals.
10. In many persons, occasional attack of frontal headache.
11. In some persons, restlessness at night and bad dreams.

12 Occasional attacks of vertigo, or dizziness, and dimness of sight, particularly after eating certain articles of diet.

DYSPEPSIA.	GASTRITIS, OR CHRONIC INFLAMMATION OF THE STOMACH.
Cause. — May be either one or several of the following: Too much food, too little food, imperfect mastication and hurry in eating, too little exercise, too much fatigue, excessive study or excitement, the excessive use of alcohol, tobacco, coffee, tea, or medicine out of place.	*Cause.* — Same as dyspepsia, especially the excessive use of alcoholic stimulants.
Symptoms.	*Symptoms.*
(1.) No pain or soreness about the stomach, but a sensation of weight or load.	(1.) Pain in the stomach, increased by food; also soreness constant, but not severe.
(2.) Symptoms of indigestion: Appetite diminished, thirst not increased, tongue pale and flabby.	(2.) Indigestion present; appetite changeable; thirst increased; tongue coated, and red at edges.
(3.) No blood vomited.	(3.) No blood vomited, as a rule.
(4.) Vomiting rare.	(4.) Vomiting occasionally.
(5.) Bowels may be regular.	(5.) Bowels constipated.
(6.) No fever.	(6.) Occasionally slight fever.
(7.) Emaciation seldom occurs.	(7.) Slight emaciation; complexion sallow.
(8.) Occurs at any age.	(8.) More common in advanced life.
(9.) May be cured; does not get worse at times.	(9.) Often worse at times; may be relieved or cured.
(10.) No tumor can be felt about the stomach.	(10.) No tumor can be felt about the stomach.

ULCER OF THE STOMACH.	CANCER OF THE STOMACH.
Cause. — Unknown ; no doubt due to inflammation.	*Cause.* — Often hereditary.
Symptoms.	*Symptoms*
(1.) Pain in the stomach, usually at one spot ; increased when food is taken (especially sugar). The pain is of a burning character ; on pressing over the stomach, one spot feels sore.	(1.) Pain in the stomach seems to radiate in all directions ; it is not increased by taking food ; is often extremely severe, and is of a stabbing character.
(2.) Symptoms of indigestion slight.	(2.) Symptoms of indigestion well marked ; extreme acidity of the stomach.
(3.) Usually vomiting; when it occurs, relieves the pain.	(3.) Vomiting always present ; but does not relieve the pain.
(4.) A large quantity of blood vomited.	(4.) Vomiting of blood not very frequent ; substances vomited look like coffee grounds.
(5.) Bowels slightly or not constipated.	(5.) Constipation always present.
(6.) Fever never present.	(6.) Fever often occurs.
(7.) Debility, with pallor, or a pale look.	(7.) Debility and loss of flesh comes on gradually; skin becomes yellow.
(8.) May occur at any age, but most frequent in the middle-aged, especially females.	(8.) Most frequent after forty years.
(9.) May continue for years, but death may take place from perforation.	(9.) Duration about one year; very rarely reaches two ; always fatal.
(10.) No tumor can be felt by pressing over stomach.	(10.) A tumor can be felt by pressing over stomach.

TREATMENT OF DYSPEPSIA AND INDIGESTION. — The meals should be regular, and sufficient time allowed for thorough mastication. Only those foods easy of digestion should be taken. (See "Digestion.") Milk and water should take the place of tea and coffee. A variety of food should be used, but not on the same day. Whatever is eaten should be simple, but nutritious. Cakes and pies should be avoided, and in fact everything which increases the symptoms. A sensible person will be able to ascertain what things agree best with his digestion. Exercise daily in the open air is very important, so also is bathing. If over-study or too much fatigue be the cause, change the habits. Tobacco and stimulants should be used in moderation; and, if these be the cause, give them up entirely.

Tonics, such as gentian, quassia, columbo, and iron, should be taken. If nervousness be a prominent symptom, use nux vomica, — ten drops of the tincture, three times a day.

For constipation, simple rhubarb pills may be taken, or mineral waters.

If there be much distention of the stomach, with eructation of gas, wood-charcoal, five grains, with the same amount of bismuth subcarb., may be taken.

For great acidity, an occasional dose of saleratus, or ten drops of nitro-muriatic acid, with five grains of pepsin, three times a day.

If there be stomach-ache, three or four drops of oil of cajuput on a lump of sugar, or spirits of camphor, or essence of ginger, may be used.

If a copious eructation of a tasteless, watery fluid occurs, use bismuth, ten grains, or oil of amber, five drops, or iron alum, two grains.

For hiccough, if troublesome, a drachm of Hoffman's anodyne, or five grains of chloral hydrate, should be taken.

TREATMENT OF ULCER OF THE STOMACH. — Only arrowroot, tapioca, sago, cornstarch, eggs, rice, beef or mutton tea, milk, and lime-water should be taken.

Subnitrate of bismuth, in ten-grain doses, three times a day, or chlorate of potash, may be used, in hopes of causing the ulcer to heal. Nitrate of silver is also used, but should be administered only by a physician. If the pain be severe, opium or laudanum may be administered.

If vomiting of blood occurs, ice should be sucked, or ten grains of tannic acid administered; or ten or fifteen drops of turpentine mixed with mucilage may also be beneficial.

TREATMENT OF CANCER OF THE STOMACH. — Nothing productive of a cure is known. All that can be done is to support life with good diet, and relieve the pain with anodynes, such as laudanum, chloral hydrate, etc.

CONSTIPATION. — Habitual constipation is one of the most frequent and most distressing disorders of the system; causing headache, confusion of the intellect, and many other disagreeable symptoms. It is usually due to irregularity in relieving the bowels, but is also caused by weakness or obstruction in the intestines, and deficient secretion of bile.

Treatment. — The best remedy for constipation is to have regular and stated intervals for relieving the bowels, which should be carefully adhered to. Soap-and-water injections, or drinking a glass of water before retiring at night, or certain articles of diet, such as fresh or stewed fruits, especially prunes, bran-bread, etc., may prove efficacious. Of medicines, simple rhubarb pills, or compound liquorice-powder, are the best.

BILIOUS COLIC is due either to the escape into the intestines of acrid and unhealthy bile, or to the passage of gall-stones. *Symptoms* of the first variety: There is a feeling for some days previous of restlessness or depression, with a desire to sleep, but the sleep is unrefreshing; in some cases, also, a yellowish tint is observed about the whites of the eyes; the bowels are likely to be constipated for some days. The actual attack commences with a slight fever, headache, nausea, and vomiting, the vomit being green or yellowish in appearance. Pain also is experienced, but not so severe as in flatulent colic. It is accompanied also with tenderness and swelling of the abdomen. In some cases, diarrhœa ensues soon after the beginning of the attack.

Treatment. — The best remedy that can be used is five grains of calomel, with ten grains of bicarbonate of soda. One quarter-grain of podophyllum resin may be substituted for the calomel in case of objection to the former. If the bowels are not moved after this, a tablespoonful of castor oil, with two tablespoonfuls of spiced syrup of rhubarb, should be administered. If the pain is severe, a hot fomentation or poultice may be applied over the abdomen, and Hoffman's anodyne (one drachm); or ten or fifteen drops of laudanum, with essence of peppermint or ginger, may be taken. For those persons who are subject to bilious attacks, an occasional dose of blue-pill, or a twenty-grain dose of the extract of taraxacum, or a teaspoonful of sulphur mixed with molasses, or ten drops of diluted nitro-muriatic acid in water, three times a day, may prove efficacious as a prophylactic or preventive.

PASSAGE OF GALL-STONES INTO THE INTESTINES. — *Symptoms:* This is somewhat irregular in its occurrence, and may be suddenly brought on, in those who are subject to it, by over-exertion, or jolting, as in a car. Its most prominent symptom is a sharp, cutting pain, which seems to radiate from the right side in all directions. Vomiting usually ensues, and the skin becomes covered with a cold, clammy sweat. If the attack lasts for any time, a jaundiced condition is induced. The duration of the attack depends upon the size of the gall-stones: as soon as they have entered into the intestines, an immediate relief is experienced. In more aggravated cases, the hepatic duct becomes ruptured, and peritonitis ensues, which almost invariably proves fatal.

Treatment. — All that can be done in these cases is to give the patient relief. A half-grain of morphia should be administered, a hot bath be taken, and hot fomentations placed over the abdomen. Inhalation of ether or chloroform is also sometimes resorted to, but the administration of these requires an experienced physician.

For the cure of gall-stones, about a pint of olive oil at night, followed by a draught of citrate of magnesia in the morning, has been recommended. This treatment may also be tried in cases of acute attacks, as it is said to soften the gall-stones, thus rendering their passage more easy.

LEAD OR PAINTERS' COLIC. — This disease results from lead-poisoning, and occurs principally amongst those who use paints. But cases have been reported where it has arisen from the use of hair-washes, face-lotions, etc.; also from drinking water which has remained in the pipes during the night. The name of " dry belly-ache " is sometimes applied to it.

Symptoms. — The abdomen becomes shrunken and hard, and sometimes it is easy to feel the knots of the contracted intestine. There is pain in the abdomen, at times very severe, which may be relieved by pressure, there being no tenderness. The bowels are always constipated, and, when a passage takes place, it is dry and hard. Along the gums will be noticed a blue line. After the system has been exposed to the influence of lead, palsy results; this affects principally the muscles of the wrist, and is known as wrist-drop. Delirium, and even mania, occurs in some cases.

Treatment. — The bowels should be moved with castor oil, or some other purgative. When the paroxysms of pain come on, they should be relieved by hot poultices, or fomentations. Morphine in half-grain doses should be given every three or four hours. Alum, in ten-grain doses three times a day, is used by many physicians; so also is the iodide of potash, in the same size doses, for ridding the system of the lead. A diet composed largely of milk is also recommended.

FLATULENT COLIC, OR SPASMODIC CONTRACTION OF THE INTESTINES. — *Cause:* This usually arises from indigestion, or excess in quality or quantity of the food eaten.

Symptoms. — The pain comes on suddenly in a large number of cases. The abdomen becomes enlarged but not tender, pressure giving relief. There is constipation with nausea; in some cases vomiting; and often considerable belching of wind, but no fever.

Treatment. — If the stomach has been overloaded, an emetic of mustard and warm water should be taken, and an injection of soapsuds and castor oil. A dose of castor oil with a few drops of laudanum and essence of ginger will often give immediate relief. Ginger in the form of essence or tea, peppermint, etc., are beneficial; also a mixture composed of spiced syrup of rhubarb, tincture of cardamom, paregoric, and peppermint-water, in equal parts. Dose, dessertspoonful to a tablespoonful. It is also important to use hot fomentations or poultices on the abdomen.

ENTERITIS, OR INFLAMMATION OF THE BOWELS. — *Cause:* It may arise from blows or other injuries, exposure to cold or wet, or neglected constipation: irritating poisons also produce it, and rupture that has become strangulated.

Symptoms. — Pain in some portion of the abdomen, which is increased by pressure or movement. Constipation is also present with vomiting. Later on in the disease, diarrhœa may occur, with swelling of the abdomen. Some fever accompanies this disease, but the temperature is usually not very high. In mild cases of inflammation of the bowels, a cure may be looked for, but in severe cases death often results.

Treatment. — If the person be full-blooded, leeches should be applied to the abdomen. After leeching, or even if leeches have not been applied, a large, soft, hot poultice, covered with a piece of oiled silk to retain the moisture, should be placed over the abdomen. It will be necessary to change the poultice three or four times a day. No medicine, except opium, one grain every four hours, should be taken; this relieves the pain, and at the same time quiets the patient. Purgatives of any kind must be strictly avoided.

Dysentery, or Inflammation of the Large Intestine. — *Cause:* It is during the later months of summer, between August and September, that this disease is most prevalent. Exposure to heat, wet, or cold will often induce it; also unripe fruit, indigestible food, or impure drinking-water.

Symptoms. — There will be pain in the lower part of the abdomen, and soreness, increased by pressure or motion; vomiting sometimes occurs. But the most distinctive feature of dysentery is the constant desire to go to stool, and a severe bearing-down or forcing pain which accompanies it. The passages are small in amount, of a creamy color and consistency, mixed with blood; coldness and debility come on early, and the disease is often fatal.

Treatment. — A warm poultice should be placed over the abdomen. If the person be full-blooded, leeches should be used prior to the poultice. It was the old practice to begin treatment with a dose of castor oil, mixed with ten or fifteen drops of laudanum, and it is as good as anything. Powdered ipecac, in twenty-grain doses, is at present the most useful drug known; a few drops of laudanum should be given ten or fifteen minutes before the ipecac is taken; otherwise it will be likely to produce vomiting. The ipecac ought to be administered mixed with a little syrup, or in capsules; and as little fluid as possible should be drunk for some time afterward. If it produces vomiting, and the ipecac is returned, a second dose may be given; in any case, two twenty-grain doses should be given during the day. If the disease become chronic, or last for some time, a mixture, consisting of thirty drops of laudanum, ten grains of chlorate of potash, and an ounce of starch, will need to be used as an injection. This may be repeated three or four times a day, according to the severity of the case. Hope's mixture is used largely in dysentery, especially if chronic: it is composed of nitric acid, half a drachm; tincture of opium, twenty minims; and camphor-water, four ounces; a tablespoonful of this is given every two or three hours. The diet during dysentery should be very plain; chiefly rice-water, beef-essence, etc.

Cholera Morbus, also called *Bilious Cholera* or *Summer Complaint.*

Cause. — Warm weather seems to predispose to it by exciting the liver; also unripe fruit, unwholesome meat, impure water, or a sudden change of temperature, may give rise to it.

Symptoms. — It often commences with diarrhœa, but its onset may be sudden, with vomiting of a greenish fluid, diarrhœa and purging, and, in a majority of cases, severe pain in the stomach and bowels, with constant nausea, also a disgust for all food and drink. If the attack be not relieved, vomiting and purging become more frequent, and the substances vomited and passed by the bowels have a more watery appearance. Great prostration and coldness of the extremities, with cramps in them, ensues. This may continue for some time if not checked, and may even prove fatal.

Treatment. — A large mustard plaster should be placed over the stomach, and be allowed to remain until it produces considerable irritation. A mixture containing magnesia, one drachm; aromatic spirits of ammonia, two drachms; paregoric, four drachms; and the addition of enough peppermint-water to make four ounces: a teaspoonful of this should be administered every twenty minutes.

Or the following recipe may be used: Powdered opium, three grains; pepsin, thirty grains; bismuth subcarb., two drachms. These should be mixed and then divided into six powders, one of which ought to be taken every third or fourth hour. If there is much prostration, an ounce of good French brandy may be administered, and repeated in a couple of hours if necessary.

DIARRHŒA. — There are numerous varieties of diarrhœa. Constipation is often followed by diarrhœa. Unripe fruit and unwholesome food and water, or exposure to wet, are often the direct causes by irritating the mucous membrane lining the intestines, besides these, diarrhœa is often present in fevers, such as childbed fever, typhoid, and in inflammations, or Bright's disease of the kidneys, etc.

Treatment. — If there has been constipation previous, or some known cause, such as eating green fruit, etc., a half-ounce of castor oil, with eight drops of laudanum, should be taken. If diarrhœa continues after this, bismuth subcarb., twenty grains, may be used every four hours. In those cases where it arises from exposure to cold or wet, five grains of gray powder should begin the treatment. After this a mixture containing equal parts of tincture of rhatany, tincture of rhubarb, and paregoric: a dessertspoonful should be administered every four hours; or, as a substitute, five grains of Dover's powder every four hours.

In those cases where diarrhœa arises during the course of fevers or kidney troubles, no endeavor should be made to check it, except by the permission of some physician, as it is by this means the system discharges the poisonous substances contained in the blood. In cases of consumption, however, some means should be used to relieve the sufferer: a grain of opium three times a day will usually suffice; or, still better, an injection of laudanum and starch into the lower bowel.

PERITONITIS is an inflammation of the membrane which lines the abdomen and covers the intestines.

Cause. — This disease usually results from an injury, but in some cases exposure to cold and wet induces it. It also arises from rupture of abscesses of the liver, or perforation of the stomach by an ulcer, and may occur in typhoid fever. Blood-poisoning also originates it.

Symptoms. — Severe pain over the abdomen, increased by the slightest pressure, so that even the bedclothes are unbearable. The patient lies in bed with his legs drawn up. The breathing becomes rapid and short, so that the abdomen moves but little; the tongue becomes red and irritable-looking, the face pale and pinched. There is vomiting and constipation and abdominal swelling. The pulse becomes very rapid and hard. After three or four days, in violent cases, delirium and sleeplessness come on, with great prostration. This disease is very fatal, and death may result in three or four days after its commencement.

Treatment. — Leeches should be applied over the abdomen, except in those cases where the patient has been in bad health previously; after this a large poultice should be applied, but it should not be too thick, as the weight produces great pain. These should be changed frequently, and should be covered with oiled silk. Opium is the great remedy in this trouble, and should be given in one-half-grain doses every two or three hours, according to the severity of the pain. Calomel is also used sometimes, combined with the opium, in small doses. The diet should be very light, but nourishing; when great prostration ensues, stimulants, beef-essence, etc., are required.

HEMORRHOIDS, OR PILES, are small elastic tumors situated around the opening of the bowel, or internal to it. They are of two classes, — dry and bleeding piles.

Cause. — There are various conditions which induce piles: among them may be mentioned chronic congestion of the liver produced by indulgence in alcoholic drinks; sedentary habits; long standing, or sitting on hard seats; constipation; using violent purgatives, etc.

Symptoms. — At first there is a sense of weight and fulness in the lower bowel, and pain of a heavy character, which is increased by a movement of the bowels, especially if the passage be dry and hard. If the tumor be inside the lower bowel, there is often a bearing-down sensation. Pain about the back, and extending down the thighs, is constantly complained of.

Treatment. — The only radical cure for piles is a surgical operation. However, by keeping the bowels open with a teaspoonful of compound liquorice-powder every evening; or, if the liver be congested, ten-drop doses of dilute nitro-muriatic acid three times a day, may assist in giving relief. An ointment composed of galls and opium (Recipe 47) should be applied. In cases where the piles have come down, they should be oiled or rubbed with some ointment and reduced. If any difficulty is experienced in their reduction, and they become inflamed and tender, a hot poultice or a piece of ice should be placed against them; afterwards their reduction will usually be found easy.

Diseases of the Liver. — A great number of persons suffer from liver troubles, which are to a great extent due to the frequent and excessive use of alcoholic liquors. We have spoken elsewhere of biliousness, which is the result of a temporary congestion, and will now say a few words in regard to chronic affections.

Chronic Congested Liver is quite a common affection, especially amongst those who are accustomed to high living and drinking, the latter, even in moderation, having a tendency to produce it. Besides the above-mentioned class, those subjected to malarial influences, or whose occupation involves constant exposure to cold and wet, are liable to this disease. The *symptoms* are, pain in the right shoulder, sallowness of complexion, constipation, furred tongue, a bitter taste in the mouth in the morning, headache, and great depression of spirits. This condition may continue for some time, producing other complaints, such as dyspepsia, internal piles, etc.

Treatment. — Besides the internal use of medicines, care must be taken to improve the general health by daily exercise of a moderate degree, frequent bathing. and wearing appropriate clothing. Should the body feel cold, the skin may be rubbed with a rough towel, or hair gloves, in order to improve the circulation of the blood. Besides these, change of air, drinking mineral water, and sea-bathing are recommended. The simplest, and at the same time the most efficacious, medicinal remedies that can be used are dilute nitro-muriatic acid in ten-drop doses, three times a day; or extract of taraxacum, in ten or twenty grain doses, twice daily. Dandelion-root tea may be substituted for the taraxacum. These medicines ought to be continued for a couple of weeks, and then an interval of three or four days be allowed to elapse before resuming their use again. By careful attention to these rules, and by entire abstinence from alcoholic drinks, a perfect cure may be anticipated.

The *second affection* of the liver commonly met with is the condition known as *Scirrhosis*, or "gin-liver." It is slow in its progress, and is due to inflammation of the capsule, or membrane covering the liver, which in time produces contraction of the liver.

Cause. — Although malarial influence and syphilitic taint appear to predispose to it, yet it is believed to be principally due to alcoholic poisoning, and is one of the most common results of continual intemperance.

The *symptoms* appear gradually; at first they are, furred tongue, slight yellowness of the skin and eyes, with constant nausea. Later on in the disease, constipation ensues and vomiting. The patient becomes emaciated, and disinclined to any exertion. Upon examination of the abdomen, large veins may be seen coursing over it. Towards the close of life, dropsy and bleeding from the bowels occur; delirium and convulsions usually terminate the case.

Treatment. — There need be no expectation of recovery from scirrhosis, and all that can be done is to alleviate the symptoms and prolong the duration of life. First of all, there must be entire abstinence from spirituous liquors. Nourishing diet is at the same time very important. Milk, if well digested by the patient, beef-tea, chicken broth, etc., will be suitable. Bitters or other stomachics may be called for to relieve nausea and strengthen digestion.

JAUNDICE is another disorder due to affection of the liver. Its most frequent causes are malaria, exposure to cold and damp in hot weather, pregnancy, and violent mental emotion. Eating certain kinds of fish, especially shell-fish, has also been known to produce it. The characteristic symptom of jaundice is yellowness of the skin and of the eyes, and the saffron color of the urine. It may be easily distinguished from other conditions, when the skin has a yellowish or sallow appearance, by the bright-yellowish tint of the whites of the eyes, which appears only in jaundice. The other symptoms are, a bitter taste in the mouth, lowness of spirits, and an indisposition to exertion. There is rarely any danger in jaundice, except it be complicated with other diseases of the liver. It is variable in length of duration, and it may last for only a day, or for more than a month; usually it is over in a fortnight.

Treatment. — It is first necessary to set the bowels in action with some purgative, and podophyllum resin in quarter-grain doses will have the desired effect. If the bowels are already loose, extract of taraxacum. in twenty-grain doses twice a day, should be substituted for the purgatives. Bicarbonate of soda, in twenty-grain doses before meals, may also be used. If flatulence be troublesome, cajuput oil, in three-drop doses on a piece of sugar, will generally bring up the wind; or ten to twenty grains of wood-charcoal, or a charcoal biscuit or two, will often prevent its formation. The diet during jaundice should be plain, and the stomach should not be overloaded. One of the best articles of diet is milk; and, when there is much sickness or nausea, nothing else should be taken. The addition of a little soda-water to the milk will improve it, and render it more agreeable. When there is not much sickness, some light substance, such as rice or sago pudding, may be allowed.

DISEASES OF THE KIDNEYS. — There are two conditions of disease of the kidneys, — one in which the symptoms arise suddenly, with more or less pain and fever, known as *acute;* and that whose course is gradual, called *chronic.*

Inflammation and Congestion of the Kidneys often arise from exposure to cold or wet, or sleeping in damp garments. Certain irritating substances may also occasion it, such as turpentine, cantharides, and spirituous liquors. The most prominent symptoms are, pain in the lower part of the back, and tenderness upon 'pressure over the kidneys, with some fever. The urine becomes scanty and dark-colored, and sometimes contains blood. Except the attack be extremely severe, it is not usually followed by dropsy; but, if the excretion of urine is stopped from any cause, the symptoms become extremely dangerous, there being headache, dimness of vision, vomiting, diarrhœa, convulsions, and, last of all, the patient passes into a state of insensibility, in which death is liable to occur.

Treatment. — If the patient is full-blooded and the pain severe, leeches should be applied over the loins; the number of the leeches depending upon the constitution of the patient and the severity of the symptoms. Cups ought also to be applied after the leeches, and cupping should be used in the absence of leeches. A brisk purgative should be administered, castor oil being the best. A warm bath may be given, as it often proves very beneficial. The diet should be simple, with frequent draughts of flaxseed or linseed tea or barley water.

The second class of diseases are those known as Bright's Disease of the Kidneys, so named after the author who first thoroughly investigated this class of disease. There are two forms, the acute and the chronic. The acute form is usually the result of exposure during convalescence from some skin disease, such as scarlet fever; but it may occur as the result of a debauch, or during pregnancy in women. Its symptoms are as follows: The patient is seized with a chill, which is followed by headache, nausea, vomiting, pain in the back and limbs; the skin becomes dry, and difficulty is experienced in breathing. A fever soon ensues, and the face, and in some cases the whole body, becomes swollen and puffy with dropsy. The urine is scanty, dark-colored, and very acid; and, if a small quantity be held in a silver spoon over a flame, it becomes thick and cloudy. After one or more of these attacks, the patient either recovers or dies, or the disease becomes chronic.

Treatment.—The loins should be well cupped, and the skin made to perspire freely by means of a hot-water or hot-air bath. Copious sweating, also, ought to be promoted by sweet spirits of nitre, or fluid extract of jaborandi. The bowels should always be kept open, and this may be done by twenty to thirty grain doses of compound powder of jalap. If these remedies are promptly and carefully applied, there may be hope of cutting the disease short, and thus effecting a speedy recovery.

Chronic Bright's Disease is much more frequent, and more fatal in its results, than the acute disease. It almost inevitably terminates sooner or later in death. When not following an acute attack, this disease approaches slowly; and it is often months, and even years, before the disease is detected. Its earliest symptoms are, a gradual decline in strength; swelling about the face, and especially under the eyelids, which is visible in the morning; the skin becomes waxy in appearance; and the patient suffers from shortness of breath on the slightest exertion. There is a frequent desire to urinate, the patient having to frequently get up at night for that purpose. These symptoms gradually increase, until dropsy makes its appearance over the whole body. In many cases, death is preceded by convulsions.

Treatment.—The treatment in chronic Bright's disease is very similiar to that of the acute form. The bowels and the skin should be kept in action, and great care should be exercised against taking cold; to this end, flannels should be worn constantly against the skin. Good, nourishing diet and tonics are required; the best tonic, perhaps, to use is tincture of iron, in ten or fifteen drop doses three times a day. Corrosive sublimate, one sixteenth of a grain, mixed with the iron, has been highly recommended also; but, as this is a very poisonous substance, it should be administered only by a physician.

LITHIASIS, or the formation of *gravel or stone* in the kidneys or bladder. This disease is supposed to be caused by drinking "hard water," especially that which contains much lime in solution; it is much more frequently met with in males than in females.

Symptoms.—Some persons are subject to it whenever they take cold or suffer from indigestion. The attack is generally preceded by chilliness, pain in the back, and fever. If the particles of gravel are of large size, extreme pain is experienced, and the pain appears to run down into the loins, and the testicles are retracted or drawn inwards. After an attack, the urine that is passed contains gravel or small stones.

Treatment.—If the pain is severe, a half-grain of morphia should be administered, and the patient be given a warm bath. Otherwise, large draughts of slippery elm or flaxseed tea should be used, together with sweet spirits of nitre or bicarbonate of soda (saleratus). Those who are subject to this disease should take plenty of exercise, and also should drink mineral waters occasionally.

Stone in the bladder can only be ascertained by the passage of a "sound" into the bladder. The general symptoms are, pain in the back and bladder, itching of the glands of the penis, retraction of the testicles, and interruption of the flow of the urine, occurring suddenly at times. The removal of the stone requires a surgical operation.

Diabetes Mellitus. — This disease is indicated by excessive urination, with the presence of sugar in the urine. There is sometimes a hereditary tendency to diabetes; but it is usually met with in persons who indulge largely in intoxicating liquors, or those who are accustomed to drink excessive quantities of cold water when heated. Disease of the brain, or injuries to the brain or spinal cord, are also frequently the cause of it.

Symptoms. — The disease begins insidiously with gradual emaciation and weakness, while at the same time the appetite and thirst become greatly increased. The urination is copious, and has a sweet taste and smell; there is also a sweet odor perceptible in the breath. The skin and hair become dry and rough, the mouth clammy, the tongue red and glazed, and the bowels constipated. By degrees the mental and sexual powers fail; and, in a large majority of cases, a hectic or daily fever with dropsy of the limbs ensues, and finally the case is terminated with all the symptoms of consumption.

Treatment. — Medicine is of very little use in this disease, and the cure must mainly be effected by dietetic means. All those substances which contain much starch should be carefully avoided. (See "Foods.") The tea or coffee that is drunk should be sweetened with glycerine, and the bowels be daily opened by the use of an injection of ox-gall, with soapsuds, into the lower bowel.

Diabetes Insipidus has the same symptoms as the above, except that the urine contains no sugar. The treatment consists principally in the use of astringents, such as ergot, tincture of iron, and various acids. A blister to the nape of the neck is also worthy of trial.

Retention of Urine.—This may occur from injuries to the spine, or a severe shock to the nerves; it also occurs in low fevers; or may be occasioned by mechanical obstructions, such as a stone in the bladder, or stricture, etc.

Symptoms.—These, as a rule, are very slight: if the urine be retained for any length of time, pain and a desire to pass water will result; and, if relief be not given, paralysis of the bladder and inflammation (cystitis) may ensue.

Treatment.—If possible, a hot hip-bath should be taken immediately; but when this is not practicable, hot fomentations ought to be applied over the bladder and between the legs. In case of these means failing to produce a passage of the urine, a surgeon should be called.

Cystitis, or *Inflammation of the Bladder;* also called *Catarrh of the Bladder.*

Cause. — This disease may result from blows or injuries, stone or gravel in the bladder, irritating medicines, or the retention of urine in the bladder for any length of time.

Symptoms. — Pain in the region of the bladder; frequent desire to pass water, and a burning sensation during the passage of the urine; feverish symptoms alternating with chills, and a sensation of pain when pressure is applied over the bladder. In aggravated cases, there are other symptoms, such as nausea, anxiety, delirium, and cold perspiration. The urine that is passed is scanty and thick, and very offensive to the smell.

Treatment. — Leeches or cups should be applied over the bladder; and castor oil may be given as a laxative. A warm bath is very soothing; but, when there is great heat, pieces of ice introduced into the lower bowel will give more relief. Flaxseed tea may be drunk freely; and, when there is great pain, it may become necessary to give opium or chloral to relieve the pain.

RULES FOR THE CARE OF CHILDREN.

We propose to give here a few suggestions to mothers in regard to the hygienic care of children.

WASHING. — It is desirable to wash the child once a day, and the morning is the best time. If the child, however, be weakly, it may be bathed in the evening immediately before bedtime. In summer the water should be quite cool, but in winter must be tepid or lukewarm; and the head should be moistened before the body is placed in the bath. The best soap to use is castile. After the bath, dry the child carefully, and take care to wipe out its ears. A neglect of this latter precaution often causes earache and abscesses of the ear. When the child is perspiring violently or is cold, it should not be washed, and in no case should it be allowed to remain longer than five minutes in the water. If it be of a delicate constitution, a handful of table-salt may be dissolved in a jug of water, and be thrown over his body immediately before removal from the bath. This will stimulate the circulation of the blood, and cause a pleasant glow of warmth.

Fine-tooth combs should never be used on a child's head, as their edges wound and irritate the skin. If the head be scurfy, a little cocoanut-oil rubbed into the scalp will remove the scurf.

CLOTHING. — The clothes of children, especially if delicate, should be made high-necked, so that the upper part of the chest may be well protected. The garments should be loose, so that the free action of the limbs may not be impeded. Tight bands around the waist and also around the extremities are injurious, as they obstruct the circulation of the blood. The garments should be of some woollen material, light, porous, and warm; and the feet, bowels, and chest should be particularly well clothed. In winter, a knitted or crocheted woollen cap is preferable to a fur cap, as the latter causes the head to perspire; and in summer, a straw hat, with a good wide brim, so that the child's eyes may be protected from the sun. In winter the stockings should be of woollen fabric, and should reach well up above the knee. No portion of the legs should ever be exposed during cold weather. Do not support the stockings with garters, as they impede the circulation: they should be fastened to some part of the dress. The underclothing in summer should be of cotton material, and in the winter of woollen; it is very important that the underclothing be changed frequently.. Do not clothe a child lightly in hopes of rendering him hardy, as it will have a contrary effect, and may permanently injure his health.

Flannel nightgowns are best for a child; but nightcaps are entirely unnecessary, as the head should be quite cool during sleep.

Never put a child's feet into boots. A shoe is far preferable, as the muscles of the ankle or instep require free play for their development. The shoe should be amply large for the foot and have broad toes; it should be supported by a narrow strap of leather over the instep, but elastic should never be used.

The winter clothing of children ought not to be changed until the beginning of June, as the weather is apt to be variable until then.

Above all things, be careful, when selecting cloth for the child's garments, to see that it is free from poisonous dyes, such as the aniline dyes.

FOOD. — During infancy a purely milk diet is the best, but after twelve months a little mashed potato with a drop or two of gravy, or bread-crumbs and gravy, may be added. Arrowroot and children's prepared food, if pure, are excellent articles of diet; and rice and batter pudding may be occasionally given for a change. Meat should be given to children up to eighteen months to a very limited extent. However, if the child is delicate, or a gross, fast-feeding child, there can be no objection to giving it, occasionally, a thin slice of mellow or tender beef, cut into small pieces and mixed with mashed potato.

Pastry of all kinds is too rich for children, and should never be eaten by them. Jams, such as strawberry, raspberry, or gooseberry, are most unwholesome for children, as are also nuts and colored candies.

Fresh fruits in their season, in small quantities, are beneficial, as they act as a mild laxative. After a child has cut the whole of his first set of teeth, his breakfast may consist of scalded milk poured upon sliced bread, and a slice of bread and butter, the latter in small amount.

Fresh butter in moderation is nourishing and tends to keep the bowels regular, but in excess it produces diarrhœa and acidity of the stomach.

New milk is preferable to skimmed milk or cream. Skimmed milk is apt to produce costiveness. When the bowels of a child are costive, there is nothing better for its breakfast than well-boiled oatmeal porridge, which should be eaten with fresh milk.

For dinner, a child may take some simple pudding and a few fragments of meat, with a draught of milk. Milk ought to be the staple food of a child, as it contains within itself every ingredient necessary to build up the tissues.

Of meats, pork, veal, salted meats, ham, or bacon, should never be given to a child.

Vegetables, during their season, well cooked, may be given in small quantities; but young vegetables are bad.

For supper, the child should have about the same as for breakfast.

We cannot too strongly recommend fresh milk for children, and at least a quart should be drunk every day. If the child happens to take a dislike to milk, it may be sweetened to suit its palate; or, if fresh milk disagrees with it, it should be scalded, etc., or two tablespoonfuls of lime-water may be mixed with a pint of fresh milk. Eggs may be given to children occasionally, but they should not be hard-boiled. Variety in the diet of a child is good: but do not, because the child is thin and delicate, overfeed it; it will only result in injuring its health.

Stimulants of any kind should never be given to children unless they are recommended by a physician. If a child suddenly loses its appetite and is teething, examine the gums, and, if the gums are not inflamed, look well to the state of the bowels. Above all, never force a child to eat when it refuses food. Endeavor to find out what is the matter, but do not tempt or coax him with dainty eatables. A child, because he is four or five years old, should not be given tea or coffee, as they frequently cause nervous troubles.

Bakers' bread, when not adulterated, is better than the home-made, as it is usually lighter; and old bread is better than fresh.

Do not give currants or caraway-seeds to children, in hopes of opening the bowels by the former and expelling wind by the latter, as they are entirely useless. Tea made from caraway-seeds, however, is good in flatulency, but the seeds themselves pass unchanged through the bowels.

If a child takes an antipathy to certain articles of diet, such as fat, underdone meat, etc., do not compel him to eat them.

VENTILATION, ETC. — The sleeping apartment of children should be one of the best in the house. It should receive the morning sun and be well ventilated every day. The walls are best painted; but at any rate green paper-hangings must be avoided, as they contain arsenic. The bed should be hard, with just sufficient covering for warmth, and arranged in such a manner that the child cannot throw them off. The temperature ought never to be below 60° in winter.

Pretty colored pictures hung about a room have an enlivening effect on children; but painted toys and matches must be kept at a safe distance from them, as they delight in putting such articles to their mouths, and not unfrequently we hear of cases of poison from it.

EXERCISE. — Children ought every day to be taken out, and the more fresh air they get the better for them; but during very hot days, when the sun is at its meridian, they should be kept under shelter. When the ground is wet, even, if the sun shines, there is no objection to their being out.

SLEEP.—A child ought to be put to bed at sundown; but dressed and permitted to run about as soon as it awakes in the morning. A nap in the mid-day is also beneficial to children.

NIGHT TERRORS, which many little ones suffer from, most frequently arise from some silly story that has been told them, that recurs again in their dreams. Do not scold the little fellow when he awakes startled, but try to soothe and quiet him, as his fright is not his fault. Charles Lamb speaks pathetically of the terrors he endured as a child when left alone in the dark after some terrifying dream. A kind mother will remain with the child until it falls into a tranquil slumber; or, at any rate, she will leave a light in the room.

We would warn mothers against giving their children opiates or sleeping-drops because they cannot sleep well. Wakefulness is usually due to want of exercise during the day, and therefore exercise will be the best cure for it. Let the child, before being put to bed, have his hour of revelry and sport, — the hour that

> "Between the dark and the daylight,
> When the night is beginning to lower,
> Comes a pause in the day's occupation,
> Which is known as the children's hour,"—

and he will usually sleep soundly after it.

STAMMERING is often seen in quick, impulsive children; it may, however, be due to some defect, such as cleft palate or tongue-tie. When it results from nervousness and haste, the child should not be ridiculed, but be made to go quietly and deliberately through the sentence again and again, until he can enunciate it properly. Let him do nothing in a hurry, and the stammering will soon disappear.

EDUCATION. — A child before the age of seven years should never be subjected to any regular routine of studies; let him learn by fits and starts, as his inclination suits; and, when he appears tired, permit him to run and play. Physicial development is much more important than mental at this period of life. Never attempt to make prodigies of children, for it usually results in injuring them both mentally and physically. Perfect mental development is rarely united with a weak and diseased body; and the foundations of health in after-life are usually laid in the physical development of the child.

TREATMENT OF CHILDREN. — We subjoin here a few suggestions to mothers as to the moral training of children. It is impossible to overestimate the influence of a mother over the character of a child, and most men and women can trace their attainments in life to the domestic influences of early youth. We would say that, for a mother to govern her children properly, she must first learn to govern herself; and that irregularity of treatment is destructive to good discipline. It is very painful to see a mother slap her child harshly and unjustly for some slight misconduct, and afterwards permit a worse fault to pass unreproved.

A perfect mother is one who will endeavor to deal justly with her children, neither too indulgently nor too rigidly; who will enter into their feelings, and sympathize with their little afflictions, and participate in their pleasures; and who will by her conduct, which is better than any precept, try to teach her children in what true nobility of character consists.

DISEASES OF CHILDREN.

Diseases in childhood differ in important particulars from those occurring in after-life, and often present peculiar symptoms: for example, many acute disorders in children often begin with vomiting, delirium, and convulsions, where the disease does not particularly affect either the stomach or nervous system.

Again, as regards the diseases of children, we lack the important assistance which speech affords; and, even should the child be old enough to speak, the information derived from him is often misleading. Therefore all the subjective symptoms are lost, and we have to content ourselves with objective symptoms alone — such as the appearance of the features, attitude, utterance, pulse, respiration, etc. — for the formation of a diagnosis; and it is only those who mix constantly amongst children suffering from disease who can come to any definite conclusion what the child is suffering from. If, for example, cough only occurred in disease of the lungs or respiratory track, the latitude of investigation would be limited to one organ, and the diagnosis would be comparatively easy; but cough also occurs in various fevers, difficult teething, worms, irritating substances in the stomach or intestines, burns, etc. So it is also with most of the objective symptoms: they occur in several distinct diseases; and it is therefore only by adding one symptom to another, and by a careful and constant study of children in health and disease, that a physician is enabled to conclude what the disease is and what the treatment should be.

Many of the diseases of childhood may be averted by a very small amount of care in the feeding and nursing of children; and it is not too much to say that the healthy child of a careful and discreet mother may pass through its infancy without ever taking a dose of medicine. It used to be the fashion once to dose children enormously for every little ailment, but we hope now a wiser practice prevails. Every unnecessary dose of medicine to a child is a positive injury to it, and the giving of drugs should never be resorted to except in cases of necessity. We would particularly warn mothers against the frequent use of soothing syrups or other patent compounds, as they usually contain narcotics and other substances deleterious to the health of children.

The most prominent indication of disease in children is the *temperature* of the *body:* we do not mean the apparent temperature as tested by the hand, but the actual temperature as measured by a thermometer. We would strongly advise mothers, and others who have the care of children, to buy a "clinical thermometer" (which may be got from any surgical-instrument maker), and learn to take a temperature. The proper temperature is 98.5° Fahrenheit, and anything over 99° may be looked upon as a fever; 99° to 102° may be regarded as a slight fever; 102° to 105°, severe fever; and over 105°, very severe fever. The best way is to place the thermometer under the armpit, and keep it there for five minutes. When there is any rise of temperature, it may be known that there is some trouble, and the child should have careful attention.

HYDROCEPHALUS, OR WATER ON THE BRAIN. — This is, as a rule, a disease of childhood, and after seven years of age it is comparatively rare. It more frequently attacks delicate children, — children who have been dry-nursed, or who have been suckled too long; or those who have consumptive mothers, or who have suffered severely from teething. Water on the brain also often follows an attack of inflammation of the lungs, especially in delicate children, more especially if depressing measures (such as excessive leeching and the administration of tartar emetic) have been used. It occasionally follows in the train of contagious eruptive diseases, such as smallpox, scarlet fever, etc.

Symptoms. — The disease is divided into two stages, — the first, the premonitory stage, which lasts four or five days, in which medical assistance might be of great avail; the second, the stage of drowsiness and insensibility.

In the first stage, the child is feverish and irritable; the stomach is disordered, and frequent vomitings occur; the breath is offensive and the appetite poor; the bowels are usually constipated; sleep is disturbed, and the child constantly cries out during the night. If there be unusual excitement, the eyes become unusually brilliant, and the child is constantly talking. As a rule, the cheeks become flushed and the head hot, especially towards evening. Besides these symptoms, the child becomes more careless than usual in his movements, and is constantly tumbling, or catching his foot in the carpet, or one foot is dragged after the other. Pains of a shooting, darting character are also constantly complained of. Remember, this is the time when medical aid should be obtained; if it be neglected, death usually results.

The *treatment* that is usually adopted is moderate purging, according to the strength of the child. The child should be sustained by nourishing food. Cod-liver oil and the hypophosphites are recommended. The head ought to be shaved, and rubbed nightly with mercury or iodine ointment. An occasional dose of sweet spirits of nitre may also be given with advantage.

CONVULSIONS may occur at any period of infancy and childhood, but they are rarely met with after the age of seven years.

There are various causes of this disorder, but some families appear to be particularly subject to it. In early childhood, the most common causes of convulsions are, constipation; the presence of irritating substances in the intestines, such as unripe fruit; worms; intussusception; painful teething; inflammation of the lungs; brain diseases; and unhealthy condition of the mother's milk. It may also occur at the commencement of many acute diseases, and especially in smallpox and scarlet fever.

The premonitory symptoms can be easily distinguished by those who have had experience in this disease. The child is more or less drowsy, and when disturbed becomes fretful and peevish. The eyes have a wild, unnatural appearance, and sometimes they seem fixed on an object, yet apparently without seeing it. The sleep of the child is disturbed and broken, and in some cases the face may be flushed and the head hot. One peculiar symptom of the approach of convulsions is, that the thumbs are bent inward across the palms of the hands. The spasm itself is marked by rigid contortions of the body, grinding of the teeth, and rolling of the eyeballs. The body is bent in various directions, according to the muscles that are affected by the convulsions. There is usually a recurrence of brief spasms, lasting for a few seconds at a time.

Treatment. — In the first place, ascertain, if possible, the cause of the convulsions. If the gums are swollen and hot, they should be lanced freely. If the bowels have not been moved for some time, or the abdomen is swollen and tense, an injection of castor oil and soapsuds should be made into the bowels. When the head is hot, apply cloths saturated with cold water to it, and renew them every two or three minutes. If the convulsion last long enough for it, the child may be placed in a warm bath, and mustard plasters be applied to the back, abdomen, and limbs. Sometimes, when the convulsions continue and all the above means have failed to give relief, an injection into the lower bowel of three grains of chloral hydrate is followed by immediate alleviation.

CHOREA, or *St. Vitus's* or *St. Guy's Dance* (as it is variously called), is a nervous affection, which is characterized by irregular and involuntary muscular movements, without the loss of consciousness. Chorea may occur at any age, but it is most frequent in childhood.

Causes. — General weakness, or irritability of the brain or nervous system. It is induced by various irritations, as teething, worms, affections of the mind, fright, horror, anger, and anæmia or bloodlessness. Acute rheumatism is said to be sometimes followed by this disease. The children of nervous, excitable mothers, or of mothers who have themselves suffered from it, are more liable to this disease than others.

Symptoms. — The disease is marked by convulsive motions, somewhat varied in different persons, but generally affecting the leg and arm of one side only. The lower extremity is usually first affected: there is a kind of weakness or lameness in one of the legs; and, though the limb be at rest, the foot is continually agitated by involuntary motions, turning it alternately outwards and inwards. In walking, the affected leg is seldom lifted, as usual, but is dragged along as if the whole limb were paralytic; and, when it is attempted to be lifted, that motion is unsteadily performed, the limb becoming irregularly and ludicrously agitated. The motions of the arm are variously performed, and it is often drawn in a direction contrary to that intended. In attempting to raise anything to the mouth, the patient often jerks it over his head. The duration of chorea is about four weeks, but it may last for several months; but recovery, if the attack be uncomplicated by any other trouble, may always be anticipated.

Treatment. — If symptoms of worms or difficult teething be present, they should receive the appropriate treatment for these affections. Good diet, and systematic gymnastic exercises, will suffice for mild cases. When the child is pale and bloodless, iron should be administered, in the form of the tincture, or pyrophosphate. The syrup of iodide of iron in two or three drop doses is often beneficial. Cod-liver oil may be given if debility exists. In obstinate cases, Fowler's solution of arsenic in small doses, gradually increased, is recommended. In some cases, strychnia will be found beneficial, and the same mixture given for paralysis can be taken. (See "Paralysis.")

PARALYSIS in children is frequently met with, but its cause is, as a rule, altogether different from that of the same disease in the adult.

Cause. — (1.) A change in the blood, not fully understood, induced by certain diseases, as diphtheria, typhoid fever, measles, scarlet fever, etc. (2.) Reflex influence, such as irritation from teething, worms, etc. In some cases the disease is due to changes in the muscles, or a diseased condition of the brain or nervous system; but in the majority of cases, it is the result of the first two causes.

Symptoms. — In a large number of cases the disease begins abruptly after a sound sleep, or sometimes after exposure to wind or rain, or sitting upon a cold stone. In other cases the paralysis is preceded by fever, which comes on suddenly without any appreciable cause; and after a few days the power of motion is found to be lost in one or more of the limbs. The sensation is unimpaired in the affected limbs, and sometimes it is increased.

The number of muscles paralyzed varies greatly in different cases, and this variation causes many deformities. Thus, for instance, should some of the muscles in one part of the leg become paralyzed, and the muscles on the opposite side act strongly, the foot becomes twisted, and various kinds of "club feet" result, which are so often seen. Again, supposing the muscles on the right side of the neck become paralyzed, the neck is drawn to the left, and wry neck is the result.

The prognosis and progress of the disease vary in different cases; in some, it is but a temporary condition, soon passing off. If, however, the condition of paralysis lasts for any length of time, the muscle is likely to become changed, and permanently useless.

Treatment. — A physician should be called at once, and the proper treatment is to endeavor to remove the cause of the paralysis. It is proper to lance the gums if they are much swollen and tender. The bowels should be kept regular, and worms, if present, should be expelled by appropriate medicines. The diet should be plain, and nothing be given likely to produce irritation, such as fruit, etc. When paralysis continues, or is not progressively diminishing, no delay of more than two weeks from the commencement of the disease should elapse before appropriate measures are employed to restore the use of the limbs and prevent atrophy of the muscles. Muscular atrophy may commence in three weeks, and the more it has advanced the more difficult and tedious will be the cure. Therefore, if by the end of the second week the paralysis continues, or is not rapidly disappearing, Professor Hammond's mixture should be given, which is composed of strychnia sulphate, one grain; iron pyrophosphate, thirty grains; dilute phosphoric acid, half-ounce; syrup of ginger, three and a half ounces. Dose: twenty drops, three times a day.

The part paralyzed should be kept warm, and frictions with some liniment be used two or three times a day. Electricity also is of great service, but requires caution in its use.

SPINAL DISEASE. — This disease is most commonly met with in children of a scrofulous or tuberculous tendency, but it may also be the result of a blow or injury. The number of deformed persons that are met daily in every large city bear sad witness to the frequency of spinal disease. It is not a disease to be included amongst those that may be treated domestically, as it requires special surgical treatment; but, in order that parents, and others who have the care of children, may be guarded against its approach, we will give a few of its most prominent symptoms.

It begins with more or less pain in the back, which is increased by pressure. The child, in order to relieve its spine of the weight of the head, may be observed to walk with its body bent forward, and also tries to support its body by clinging to chairs or tables, etc. If the back is examined, it will be noticed that one of the bones of the back stands out more prominently than the rest. If this condition is observed, together with scrofulous symptoms, medical assistance should be summoned; for, if the disease continues unchecked, it will result in destruction of the bones, which will ultimately produce the permanent deformity of "hunchback," exhausting abscesses, and perhaps death.

DISEASES OF THE MOUTH. — Ulcerations of the mouth frequently occur in children whose digestion is disturbed, or who are in a weak state of health, or who are not kept clean; and, when ulcerations appear, they may generally be taken to indicate one of these conditions.

The most common form of ulceration is, small circular abrasions, situated on the inside of the lips, or the cheek, or the side of the tongue. The technical name of these is *aphthæ*.

Treatment. — The child's mouth should be washed frequently with flaxseed tea, in which a little chlorate of potash has been dissolved. The best thing to apply to the ulcers is glycerine of borax, or glycerine of tannic acid, which may be got at any druggist's, and should be applied with a camel's-hair brush. The general health should also be attended to, and a dose of magnesia and five grains of chlorate of potash should be given three times a day. At the same time, the diet should be as simple as possible. The ulceration, under this treatment, will probably disappear in the course of a week.

Another trouble of the mouth is that known as *thrush*, which is quite frequent in infancy. It first begins with an inflamed condition of the mouth, and, after a day or two, small, whitish points appear within the mouth, which join together in white, curd-like patches. In very bad cases, they become brownish in color. The mouth is hot, the stomach disordered, and vomiting and diarrhœa may occur, with some fever. During an attack of thrush, the health of the child usually deteriorates, and even death has resulted from the exhaustion caused by the diarrhœa.

Treatment. — In ordinary cases during thrush, the child should be fed entirely on milk; but where the child is of a feeble constitution, quinine, beef-tea, and whiskey may also be given in quantities proportioned to the age and condition of the patient. As a laxative, magnesia should be administered; and also five-grain doses of chlorate of potash, three or four times a day. If the child has severe diarrhœa, a little lime-water must be added to the milk; and, if this does not check it, it is often advisable to give a teaspoonful of chalk mixture three or four times a day. The mouth should be washed with flaxseed tea, or glycerine and rose-water (one part of glycerine to four or five of the rose-water). Borax and honey may also be applied to the ulcerations with a camel's-hair brush. Later on in the disease, stronger remedies may be required, such as hydrochloric acid, sulphate of zinc, etc., but these are best applied by a physician.

The last disease of the mouth to be mentioned is *cancrum oris*, or *canker of the mouth.* This begins as an ulcer on the cheeks, gums, or lining membrane of the mouth. The ulcer is grayish or yellowish white in appearance, with an irregular red border. The cheek sometimes swells considerably on the outside; there is a considerable flow of saliva from the mouth, and the breath is very offensive. Fever and severe pain are also usually present. This disease is most common in children from two to six years of age, and may last for several weeks, or months even, but it is rarely fatal.

Treatment. — The same general treatment, washes of the mouth, etc., as in thrush, and ulcerations of the mouth, is required. The ulcer ought, also, to be touched twice daily with bluestone, and afterwards a little powdered chalk and gum arabic may be applied. In case the ulcer spreads rapidly and becomes ash-colored, it may be known that an extremely fatal disease, called *gangræna oris*, or gangrene of the mouth, has developed. A physician must be summoned immediately, as the disease requires radical treatment, and the remedies could not be applied safely by inexperienced hands.

DISEASES OF THE THROAT. — Besides the ordinary diseases of the throat, from which children as well as adults suffer, and which require the same treatment, there are two to which children are particularly liable; *i. e.*, DIPHTHERIA and CROUP. There is certainly no similarity between the two, and their treatment is exactly opposite; yet these diseases are often mistaken one for the other.

CROUP. — Besides membranous or true croup, there is another variety, known as *spasmodic* or *false croup*, which will be spoken of under that head.

The cause of croup is supposed to be due to taking cold; therefore it is most frequent after exposure. Children who live in heated apartments and are taken into the open air without proper covering, and those who are part of the time warmly and part of the time thinly clothed, especially as regards the covering of the neck, are extremely liable to it. The most frequent age is between one and two years, and during the winter season.

Symptoms. — The child at first seems laboring under a slight cold, and is troubled with a dry cough; he is hot and fretful, and hoarse when he cries. Hoarseness is one of the earliest symptoms of croup; and it should be borne in mind that a young child, except he is going to have croup, is seldom hoarse. The child at this time is thirsty and refuses food, and the bowels are constipated; the cheeks become flushed, and the pulse full and strong. The cough is quite characteristic of croup: it has a musical sound, and resembles the barking of a young dog. If the throat be examined, it appears red and swollen, and after some days a whitish membrane or exudation appears. There are no enlarged glands about the neck, and the child does not seem to have lost much strength. This condition may continue for from five to fourteen days, but death may take place in one or two days. Towards the close of life, the voice is usually lost, and the child expresses its thoughts in a whisper. Death results from blocking-up of the windpipe by a membrane or exudation.

Treatment. — The first and most important thing to do for a child threatened with croup is to give an emetic of syrup of ipecac mixed with alum, or equal parts of powdered alum and ipecac. This should be repeated in teaspoonful doses every ten or fifteen minutes until vomiting ensues. If this be done sufficiently early, an attack of croup may be warded off. After this, a teaspoonful of the following mixture should be given every hour: —

Chlorate of potash and nitrate of potash, each one drachm; glycerine, one ounce; water, two ounces. In serious cases of croup, a grain of calomel every two hours is highly recommended. Sulphur and lime-juice have for some years been tried, but they do not seem to possess the power to arrest this disease.

A hot poultice, or a sponge dipped very frequently in hot water, should be applied to the neck. The child should be surrounded with steam, either obtained from boiling water, or from the action of water on unslacked lime. Should symptoms of choking come on, it would be well to repeat the emetic. The diet must be plain and nutritious, but care should be taken not to overload the child's stomach. Tracheotomy has often been performed, in some cases with good results; and when the child is in imminent danger of suffocation, the operation should be sanctioned by the parents, as it is the only hope.

During convalescence from croup, great care must be taken that the child is not exposed to cold, for it may bring on a return of the trouble. During an attack of croup, the child must be kept separated from its fellows, so that no risk of contagion may be run; and it should not be allowed to mix with its companions until all croupy symptoms have disappeared.

Diphtheria. — This disease occurs at all ages, but, from its frequency in childhood, it has been placed amongst the diseases of children.

The cause of diphtheria has not been satisfactorily settled as yet, but investigations are at present going on which will probably reveal its origin before long. At present it is supposed to be due to certain germs, which are always present in the air. Among the predisposing causes are, bad and imperfect drainage, lack of ventilation, overflowing privies, low neighborhood, in the vicinities of rivers, stagnant waters, etc., and, most important of all, *contagion.* It should be borne in mind, too, that a delicate child is more liable to the disease than a strong one; and also that girls suffer more frequently than boys.

Symptoms. — The little patient, before the disease really shows itself, feels poorly, and is "out of sorts." A shivering fit, though not severe, may generally be noticed. The child is heavy and dull and has a slight headache, principally over the eyes; and, in some cases, there is a mild attack of delirium at night. On the day following the beginning of these symptoms, complaint is made of slight difficulty in swallowing, and the child refuses all food and cries for drinks. There is considerable fever, yet the face is not flushed, but pale; and the pulse is weak and rapid. Sometimes the child has diarrhœa, but at other times the bowels are constipated.

At first there is none of the hoarseness observed in early croup. If the throat be examined, the tonsils and palate will appear swollen and inflamed, often having a purple color. In a day or two small, whitish specks will be observed on one or both tonsils; this exudation increases rapidly, and in a short while the throat, and even the whole mouth, may be covered with a coating or membrane, somewhat of the appearance of leather. This membrane has a tendency to spread forward into the mouth and nose; but, should it pass downward into the windpipe, the voice becomes hoarse, causing a resemblance to croup. The child loses its strength; and, in this respect, diphtheria particularly differs from croup, for in the latter disease the child does not appear to become unusually weak. The marked differences between these two diseases — *i. e., croup* and *diphtheria* — we give here in a tabulated form: —

MEMBRANOUS CROUP.	DIPHTHERIA.
(1.) Commences with cough, catarrh, and hoarseness; little or no sore throat, or difficulty in swallowing; cough shrill and barking; breathing harsh from the outset.	(1.) Commences with a chill; sore throat; difficulty in swallowing, but neither hoarseness nor cough at the outset. Harsh breathing is a late symptom.
(2.) The exudation begins in the windpipe, and extends to the throat.	(2.) Begins in the throat and extends into the windpipe.
(3.) The fauces, or back of the throat, is rarely swollen, and generally nothing can be seen.	(3.) The fauces red and swollen, and whitish specks can be noticed in the throat.
(4.) Very rarely any bleeding from the nose.	(4.) Bleeding from the nose common.
(5.) No enlargement of the glands about the neck.	(5.) The glands about the neck are enlarged.
(6.) Little or no prostration of the general strength.	(6.) Considerable and often extreme prostration.
(7.) Face is flushed, and the pulse full and strong.	(7.) Face is pale, and pulse weak and rapid.

Diphtheria is a very fatal disease, and death frequently results from extreme exhaustion. The process of recovery is slow, and paralysis often remains after the disease itself has been cured. It is a very contagious disease; therefore the child should be isolated.

Treatment. — This disease imperatively requires the immediate attention of a physician. We will give, however, a few of the remedies ordinarily used.

The child requires the very best of nursing, and its diet should be of a superior quality; the quantity of food should be sufficient, but the child's stomach ought not to be overloaded. Of medicines, iron is the favorite remedy in this disease; and a teaspoonful of the following mixture should be given every two or three hours: —

Tincture of iron, one drachm; chlorate of potash, one drachm; glycerine and water, each, one ounce.

In some cases the elixir of calisaya may be given in teaspoonful doses with advantage. Some special applications to the throat have been advised, such as sulphur blown into the throat through a quill; or swabbing it with the iron mixture given above, by means of a sponge; or lactic acid (two drachms to an ounce of water), thrown into the throat by a spray apparatus.

Steam also is advocated, as in croup, and some warm application should be made to the throat externally.

For the paralysis that often follows diphtheria, a physician should be consulted.

FALSE OR SPASMODIC CROUP. — This occurs in many children between the ages of four and twelve years. It comes on suddenly, usually at night, and the child has the cough and many of the symptoms of true croup; but it may be distinguished from the latter by the child having shown no previous symptoms, and also by no difficulty of swallowing being complained of. There is usually no fever, and the child is commonly free from cough, etc., during the day. It, however, may return during the following night.

There is another affection which commonly occurs in children or infants about the age of dentition,—the complaint known as *laryngismus stridulus*, or *child-crowing*. Its onset is sudden, but of brief duration, and, though exceedingly alarming, it is seldom fatal. This disorder is due to the spasmodic closure of the glottis, or upper part of the windpipe, which causes a shrill, whistling respiration.

Treatment. — Both of these varieties require immediate and simple remedies. The child should be placed quickly in a warm bath, and a sponge dipped in hot water be applied to the throat. In severe cases mustard plasters, diluted with flour, should be applied to the chest and back. An emetic of ipecac wine also is often beneficial in spasmodic croup.

Children subject to these spasmodic attacks require careful attention. If the child's bowels be costive, a powder composed of rhubarb, bicarbonate of soda, and gray powder should be administered. The teeth also should be investigated, as the gums may need lancing. Worms may be the cause, or the child may be weakly and require tonics, in which case tincture of iron, in one or two drop doses, will be found very beneficial.

Bronchitis is a much more frequent disease than inflammation of the lungs. It is one of the most common complaints both of infants and children, while inflammation is comparatively a rare disease.

Cause. — The cause of bronchitis is the same as that of simple cold; namely, sudden change of temperature from warm to cold, exposure to currents of air, and the practice of sending children, without sufficient clothing, from heated rooms into the open air, or throwing off bedclothes at night. Teething is also an occasional cause.

Symptoms. — The child, for the first few days, labors under symptoms of a heavy cold; he has not his usual spirits. In two or three days, instead of the cold leaving him, it becomes more confirmed; he is now really poorly, fretful, and feverish; his breathing becomes rather hurried and oppressed; his cough is dry, hard, and loud; he wheezes, and if you put your ear to his naked back, between his shoulder-blades, you will hear the wheezing more distinctly. If at the breast, he does not suck with his usual avidity; the cough — notwithstanding the breast is a great comfort to him — compels him frequently to lose the nipple; his urine is scanty and rather high-colored, staining the napkin and smelling strongly. He is generally worse at night.

The characteristic differences between bronchitis and inflammation of the lungs are given below: —

Bronchitis.	Inflammation of the Lungs, or Pneumonia.
(1.) Skin is warm but moist.	(1.) The skin is hot and dry.
(2.) The mouth is warmer than usual, but moist.	(2.) The mouth is burning hot and dry.
(3.) The breathing is rather hurried and attended with wheezing.	(3.) The breathing is short and panting. There is no wheezing.
(4.) Cough is loud and noisy.	(4.) Cough is short and feeble.
(5.) The child is cross and fretful.	(5.) The child is dull and heavy, and his countenance denotes distress.

Bronchitis, as a rule, is soon recovered from; but in some cases the inflammation extends downward into the fine bronchial tubes, inducing the condition known as capillary bronchitis, which is a very fatal disease. When this takes place, the respirations become very rapid, as many as 60 to 80 in the minute, and the pulse from 140 to 180 per minute. The cough becomes frequent, and the face flushed. The little patient becomes restless, moving from one part of the bed to another, seeking in vain for relief.

Bronchitis may last for several months before it entirely ceases, but capillary bronchitis may end life in two or three days.

Treatment. — Bronchitis may be rendered much milder, and perhaps prevented, by early administration of an emetic of ipecac wine, in conjunction with a warm bath. A dose of castor oil should be given, and a large, thick linseed-meal poultice applied to the chest. The following mixture will be found very beneficial in early bronchitis: Sweet spirits of nitre, one drachm; syrup of ipecac, syrup of squills, and castor oil, each, two drachms; syrup of balsam tolu, seven drachms. One or two teaspoonfuls of this mixture should be given, according to the age of the child, every three or four hours. When the child is over three years old, if its previous health has been good, half a drop of the tincture of aconite may be given every three or four hours. When it is very restless during the night, if it be over one year old, a little Dover's powder, paregoric, or syrup of poppies may be given. Should the disease appear to have extended and produced capillary bronchitis, no time should be lost in sending for a physician.

INFLAMMATION OF THE LUNGS, OR PNEUMONIA. — The causes of pneumonia are similar to those of bronchitis, and pneumonia may occur during or after an attack of bronchitis.

Symptoms. — The child has a shivering fit; the skin becomes very hot and dry; the lips and mouth are hot and parched; and there is great thirst and loss of appetite. The child grows dull and heavy, and seems to wish to be quiet in his cot or crib. The tongue is furred, and, if the finger be placed in its mouth, great heat will be experienced. The urine becomes dark and scanty, staining the linen or napkin. The breathing becomes short and panting, and there is a dry and hard cough. The bowels are always constipated. In some cases vomiting, delirium, or convulsions occur. (For the difference between bronchitis and inflammation of the lungs, see "Bronchitis.")

Treatment. — A physician should be sent for immediately, as this is not a disease to be treated domestically. The following treatment, however, is used: The child is usually put to bed in a well-ventilated room, and the bowels are kept loose with castor oil, or a small dose of Epsom salts, or citrate of magnesia. A warm bath is employed with advantage. If the physician be called early enough, he may, by the use of tartar emetic, or veratrium veride, or aconite, cut short the disease. These remedies, however, cannot be recommended for general use, as their effects have to be closely watched. Small doses of Dover's powder, with nitre, may be used, and half a drop of aconite or less, according to the age of the child. The diet at first should be light, but in a day or two beef-essence and even stimulants will be required. When the child is weakly, good strong diet is required from the very start of the disease. To the chest a large poultice of flaxseed meal should be applied, in which a little mustard may be mixed, but not sufficient to cause much irritation.

WHOOPING-COUGH in itself is not an inflammatory affection; it is purely spasmodic, but it is usually accompanied with more or less bronchitis.

Symptoms. — Whooping-cough commences as a common cold. The cough, for ten days or a fortnight, increases in intensity; at the end of which time, it puts on the characteristic "whoop." The attack of cough comes on in paroxysms. In a paroxysm the child coughs so long and so violently, and *expires* so much air from the lungs without *inspiring* any, that at times he appears nearly suffocated and exhausted; the veins of his neck swell; his face is nearly purple; his eyes, with tremendous exertion, almost seem to start from their sockets. At length there is a sudden inspiration of air through the contracted chink of the upper part of the windpipe (the glottis), causing the peculiar whoop; and, after a little more coughing, he brings up some glairy mucus from the chest; and by this action, and sometimes also by vomiting food from the stomach, he is at once relieved until the next paroxysm occurs. The child during the intervals, in a favorable case, appears quite well, and, after the cough is over, instantly returns either to his food or to his play, without any apparent inconvenience. After an attack he is hungry, unless there be severe inflammation of the lungs.

Very young infants commonly escape this complaint, but, should it occur, it is likely to fare harder with them than with the older children. A new-born babe, laboring under whooping-cough, is liable to convulsions, which is, in this disease, a great source of danger.

The complaint usually lasts from six to twelve weeks, and sometimes for a much longer period, especially if the proper means are not employed to relieve it.

Treatment. — As the disease is very contagious, the child should be isolated as much as possible from other children, especial care being taken not to bring it in contact with a young infant. In mild cases, there need only be care to avoid exposure to damp and cold. After a few days, if there be no fever or soreness of the chest, the patient need not be kept in the house in fine weather; and, in a majority of cases, the child will cough less out of doors than within. At first, when the cough is dry and tight, a mixture containing a little syrup of squills and ipecac may be given.

Quinine is highly recommended, and should be given in doses in accordance with the age of the child. Two or three drops of dilute nitro-muriatic acid may be added to the quinine with advantage. The spine and chest should be rubbed with the following mixture night and morning: Oil of cloves, one drachm; oil of amber, one and a half drachms; camphorated oil, nine drachms. The child ought to be clothed in flannel; his diet should be nourishing, and it is necessary to keep the bowels regular. If the child is delicate, cod-liver oil and elixir of calisaya, etc., are frequently used with excellent results.

VACCINATION. — Although vaccination can scarcely be classed amongst diseases, yet it is the artificial production of a mild eruptive disease, which is intended to act as a preventative to smallpox, or at any rate to greatly modify the virulence of that disease. The popular opposition to vaccination, which arose with its first discovery, has not entirely died away even at this late date, although the experience of each succeeding year adds overwhelming testimony to its efficacy in abating the scourge of smallpox. In the year 1774, when vaccination was first performed by a courageous and intelligent farmer named Benjamin Jester, upon his children, he was regarded by his neighbors as an "inhuman brute who had performed an experiment on his own family, the tendency of which might be to transform them into beasts with horns"! The ignorant and fanatical opponents of vaccination do not now claim that it transforms human beings into "horned beasts," but we see statements occasionally cropping up that syphilitic diseases, blood-poisoning, etc., have been transmitted with the vaccine matter. The recent investigations on this subject have demonstrated that there are very few well-authenticated instances, if any, of the transmission of disease by vaccination; but in any case there can be no ill-effects resulting from the use of pure vaccine matter obtained directly from the cow.

Pure animal virus can be obtained from almost any druggist, and its most convenient form is that of the "ivory points," one of which is sufficient for each individual vaccination. The virus should be unstained with blood or dirt, and should resemble a thin coating of mucilage upon the point. The method of performing vaccination is very simple. The upper part of the left arm is usually selected, and a little patch of the outer skin is rubbed off, and a few scratches are made through the true skin until the blood begins to ooze through it. As soon as the blood has almost ceased to flow, the vaccine matter is rubbed into the scratches. If the operation is successful, no sign is visible for two or three days; but, about the fourth day, a small pimple appears, which increases in size until the eighth day, when a fully developed vesicle is formed, with a red ring around it. This lasts for two or three days, and then dries up, leaving a scab behind it which falls off about the nineteenth day. The part should be protected from irritation while it lasts; and this may best be done by tying a silk handkerchief, or piece of linen, around the arm.

In case the first vaccination is unsuccessful, another operation may be performed after a few weeks, and second vaccinations frequently take effect when the first have been without result. All persons ought to be vaccinated as often as once in seven years, especially during early life.

Smallpox, or Variola, is a specific febrile affection, accompanied by a vesiculo-pustular eruption of the skin. Since the discovery of the protective power of vaccination, it has been shorn of much of its terror; but it is still the most loathsome and most dreaded of all the fevers.

The modified smallpox, or that which occurs after vaccination or a previous attack, is ushered in with severe symptoms. A shivering fit, great depression of spirits, debility, headache, pain in the back, vomiting, and occasionally delirium or convulsions occur. These symptoms are combined with considerable fever, furred tongue, constipation, loss of all appetite, and thirst. After these indications have lasted for three days, the eruption shows itself. It commences as minute red points, somewhat like pimples, which gradually enlarge. It is first observed around the lips and upon the neck; then upon the face, scalp, upper part of the chest, arms, and finally upon the lower part of the chest, abdomen, and legs. These red points soon become raised and hard at their centre, and feel like shot under the finger. They now become more elevated, and, in twenty-four to forty-eight hours from the commencement of the eruptive stage, they become vesicular; *i. e.*, small blisters. On the fifth day of the eruption, or the eighth day of the disease, the vesicle has attained its full size. It is now about one quarter of an inch in diameter and is circular, and surrounded by a narrow zone of inflammation, indicated by redness and tenderness of the skin; the centre becomes depressed, and the pock itself is filled with pus or matter. Sometimes the eruption of smallpox occurs on the throat, producing difficulty in swallowing.

There is more or less redness of the surface of the skin between the eruptions, and, except in very mild cases, the face is considerably swollen. The fever and other symptoms subside as soon as the eruption occurs, unless the disease is of the malignant type. It, however, returns about the eighth day, and continues until the disease is over. The last stage of the disease is that of desiccation and desquamation, or falling off of the scab, which takes place between the eleventh and sixteenth days.

Treatment.—The child should be perfectly isolated from every one except the nurse, and the board of health should be immediately notified. The treatment usually adopted is sustaining and palliative. Good nursing and ventilation are more requisite than drugs. There is no cutting short the disease; and the lime-juice, cream of tartar, sulphate of zinc, and other substances recommended as having this power, will be found about as useful as the same quantity of water.

The diet should be simple, principally of milk, in the first stage of the disease. Lemonade may also be given to allay the thirst. If the fever be high, sweet spirits of nitre, or spirits of mindereri, should be administered. As the disease advances, more nutritious food is required; and in severe cases carbonate of ammonia, and even alcoholic stimulants, are called for.

It is necessary to keep the bowels open with mild laxatives throughout the disease. The treatments adopted to prevent pitting have been numerous; amongst them are touching each pimple on the face with lunar caustic on the fourth or fifth day: this is the abortive treatment. Another is, to soothe the inflammation by covering the whole face, during the first week, with a soft poultice of bread and milk, flaxseed, or slippery-elm bark. Excluding the air is also said to have the desired effect; and this is attained by mercurial ointment or collodion, softened by the addition of a little glycerine. Placing gold-leaf over the face is advocated by some, as it excludes the light. The treatment, however, most likely to be beneficial, is the mercury ointment application. During convalescence, the tone of the system should be improved by tonics, such as Peruvian bark, iron, etc.

Measles (*Morbilli* or *Rubeola*) is another of the infectious diseases which children are subject to.

Symptoms. — Measles commence with symptoms of a common cold. The patient is at first chilly, then hot and feverish. He has a running from the nose, sneezing, watering and redness of the eyes, headache, drowsiness, a hoarse and peculiar ringing cough, and difficulty of breathing. These symptoms usually last three or four days before the eruption appears; on the fourth day the eruption generally makes its appearance, and continues for four days and then disappears. The disease usually lasts about seven days altogether. The rash appears first about the face and neck, in which places it is best marked. It is not bright in color, as scarlet fever; and it is distributed in patches, more or less crescent or half-moon shaped. It is slightly raised above the surface of the skin. The face is swollen, more especially the eyelids, which are sometimes for a few days closed.

Treatment. — Uncomplicated measles require no medical treatment, except to palliate the symptoms. The child should be kept in an airy apartment, at a uniform temperature of about 68°, and all draughts must be carefully avoided. The diet for the first few days ought to be low, such as milk and water, arrowroot, bread and butter, etc. At the beginning, a moderately active saline cathartic — Epsom salts, or citrate of magnesia — should be administered. For the cough, demulcent drinks, as flaxseed tea, infusion of slippery-elm bark; and, to render them more palatable, lemon-juice may be added.

The following mixture may be substituted for the drinks: Paregoric, one drachm; syrup of squills and syrup of ipecac, half an ounce each; sweet spirits of nitre, two drachms. Dose, half to one teaspoonful, repeated according to circumstances.

If symptoms of severe bronchitis complicate the disease, a warm poultice should be constantly applied to the chest.

During convalescence it is necessary that the child be kept from exposure to cold or wet, as it is very liable to kidney disease or bronchitis after an attack of measles.

Scarlet Fever. — The terms "scarlet fever," "scarlet rash," and "scarlatina" are identical. They are employed to designate one of the most frequent and fatal of the contagious diseases, — a disease which may occur at any age, but is most common in childhood.

Symptoms. — Scarlet fever usually begins abruptly, and it is possible often to tell the exact time of its commencement. If there are premonitory symptoms, they are ordinarily slight, so as scarcely to attract attention, amounting to little more than dulness or the appearance of fatigue. The disease commences with or without chilliness, and a fever, usually intense, arises, accompained ~~by~~ such symptoms as ordinarily occur in febrile states of the system, as headache, loss of appetite, great thirst, and perhaps delirium. The pulse rises to 110° or 120° or more per minute; the skin is hot; the face flushed; and the eyes bright, and occasionally more or less suffused or red. In many cases, there is sudden starting or twitching, with a degree of stupor, showing that the nervous system is profoundly affected.

In most cases there occurs, within the first twenty-four hours, vomiting; and, in young children, convulsions may also be present.

At the end of the second day, the characteristic bright, scarlet efflorescence, somewhat similiar to the color of a boiled lobster, usually shows itself, and is first observed about the ears, neck, and shoulders. The scarlet appearance is not confined to the skin, but the throat; the whites of the eyes put on the same appearance, with this difference; viz., that, on the throat and tongue, the scarlet is much darker. "The tongue looks as if it had been sprinkled with Cayenne pepper." At other times it resembles a strawberry. The symptoms remain unabated until the fifth or sixth day, and the eruption usually declines on the fifth, and is generally indistinct on the sixth day; on the seventh, it has completely faded away. There is, after the first few days, great itching on the surface of the body.

The skin, at the end of the week, begins to peel and dust off, making it look as though meal had been sprinkled upon it.

There are three forms of scarlet fever, — the first, where the throat is *little*, if at all, affected, and this is a mild form of the disease; the second, which is generally, especially at night, attended with delirium, and where the throat is much affected, being often greatly inflamed and ulcerated; and the third (which is, except in certain unhealthy districts, comparatively rare, and which is *very* dangerous), the malignant form.

Treatment. — The child should be placed in a large, well-ventilated room, into which plenty of fresh air ought to be admitted; care, however, being taken that no draught is created over the child.

The diet should be composed largely of milk and water, bread, sago, arrowroot, etc., but broths and stimulants must be avoided.

When the fever is mild, without complications, such as diphtheria, very little medicinal treatment is required. A gentle cathartic, like citrate of magnesia, should be given from time to time, if there is a tendency to constipation; and some simple mixture composed of sweet spirits of nitre and syrup of ipecac, each two drachms; syrup of orange-peel, one ounce. Dose, half to one teaspoonful every three hours, according to the age of the child.

If there be restlessness, an occasional warm mustard foot-bath will give relief; and, if there is considerable fever, with headache and flushed face, cool applications should be made to the head and face, occasionally bathing them with bay-rum or some other cooling lotion.

If the throat be considerably swollen, a thin slice of salt pork, cut as thin as possible and stitched to a single thickness of muslin or linen, can with benefit be applied to the throat. The pork should extend from ear to ear.

A gargle, composed of carbolic acid, half a drachm; chlorate of potash, two drachms; glycerine, two ounces; and water, four ounces, should be used several times a day, if the child be old enough to gargle.

When the child is too young to do this, the same mixture should be applied to the throat by means of a camel's-hair brush. This ought to be done every three or four hours. It would be well, at the same time, to syringe out the nostrils three or four times a day with the same solution.

For the itching, glycerine, or a mixture composed of glycerine, two drachms, and cold cream, one ounce, may be applied to the skin.

In more severe cases of scarlet fever, more energetic measures are required, and these are best administered by a physician.

During convalescence, while the skin is peeling, great care is required to prevent exposure or checking perspiration; for, should anything interfere with the free action of the skin, lung or kidney diseases will surely supervene.

Besides the remedies mentioned above, giving the child a cold bath, by dashing cold water over it and quickly rolling it in a blanket, has been recommended when the fever runs high. This, however, should only be done on the recommendation of a physician, as all children cannot be subjected to it without danger.

Belladonna, it is said, acts as a preventive to the disease, and homœopathic physicians have great belief in this drug, both as a remedy and as a preventive.

CHICKEN-POX, OR VARICELLA. — This is a mild, eruptive disease, resembling small-pox considerably. It is very contagious and occurs in epidemics.

Symptoms. — It is occasionally, but not always, ushered in with a slight chill. The eruption shows itself in about twenty-four hours from the child's first appearing poorly. It is a vesicular disease (*i. e.*, small elevations of the skin occur, resembling small blisters; these contain a colorless fluid at first, but become afterwards opaque or whitish). The eruption first makes its appearance as small pimples, situated principally about the scalp, neck, chest, and back, but rarely on the face. These pimples are, as a rule, widely scattered. On the second day the pimples are converted into vesicles, and two or three days more find them scabbing. Whilst those that first appear are drying, fresh ones make their appearance. There is a considerable amount of itching, and, if scratched, the fluid escapes and leaves a small pearl-like substance, which disappears in a few days. They occasionally produce pitting.

Treatment. — There is very little to be done in this disease, except keeping the child from draughts. If there be constipation, a dose of citrate of magnesia should be administered. The diet should be simple, but no particular change need be made.

SCROFULA (or *Struma*) is the name given to a constitutional affection whose essential nature we are ignorant of, but which evidently depends upon a deficient or depraved nutrition and which declares itself by certain outward marks. It is most prone to appear in early life.

Though it may occur in almost any one, it is chiefly met with in individuals of two different aspects, —

1. The *sanguine*, with clear complexions, delicate features, graceful outlines, fine skins; large, luminous eyes, with long, silky lashes; and quick, lively intellects, — children who are beautiful in person, precocious in mind, and almost unnaturally good and docile.

2. The *phlegmatic*, with muddy complexions, coarse features, thick lips, dull heavy eyes, large joints, and awkward, stunted, or deformed figures. In persons of this temperament, the intellectual faculties are sometimes obtuse, and capable of great and sustained exertion.

The disease shows itself in enlargements of the lymphatic glands, especially about the neck. The glands under the jaw and side of the neck are very liable to enlarge; and any irritation, as in cutting the teeth or a slight cold, is quite sufficient to induce an increase in size. Sometimes these glands suppurate, and leave scars which last for a lifetime. Besides the enlargement of the glands, the patients are liable to inflammation of the eyes, which is often very difficult to cure. The edges of the eyelids become reddened and inflamed, and small ulcers may form on the eyes themselves. When this occurs, there is a copious discharge from the lids and eyes, which causes a gluing together of the eyelids after sleep. Diseases of the skin are likewise common amongst scrofulous children, and the most usual seat of the eruption is about the joints or on the head.

They are often troubled also with discharges from the ears or nose, such being the low state of health in the scrofulous patient that a slight cause is sufficient to determine some manifestation of disease. Thus, a sprain or blow about a joint may be followed by destruction of the part. The disease known as "white swelling of the knee" is commonly met with in scrofulous persons.

The treatment of scrofulous children, if begun early, may ward off the disease. Sir Astley Cooper says: "You may prevent scrofula by care; but that some children are originally predisposed to the disease, there cannot be the least doubt; and in such cases the education and habits of youth should be so directed as to ward off the complaint."

The child should not be made to study; and books, unless as an amusement, ought to be discarded. The patient must almost live in the open air, and his residence should be a healthy country place where the air is dry and bracing. In selecting a house for a patient predisposed to scrofula, good pure water ought to be an important consideration. Early rising is most beneficial. Wine, spirits, and all fermented liquors ought to be avoided. Beef-steaks and mutton-chops in abundance, and plenty of milk and farinaceous food, such as rice, sago, arrowroot, etc., are required. The child should be kept clean, and a bath of salt water given every day.

Of medicines, cod-liver oil is the most generally used. But iron is beneficial; as also is iodine in all its forms. It may be given in the form of iodide of potassium, or the syrup of iodide of iron. Sulphur, too, is often of signal service, and should be given in the form of sulphide of potassium, otherwise known as Hepar sulphur, or liver of sulphur; a grain, or even two, of the sulphide, may be dissolved in water and given two or three times a day. When the glands enlarge, it is advantageous to paint them with the tincture of iodine.

Rickets. — This is a disease which every one who is much brought into contact with children should endeavor to understand. Its main features are a softness of the bone, and a general muscular and constitutional weakness. This softness of the bone leads to deformities of the limbs, chest, and back, as we see in cripples and dwarfs.

Among the causes of rickets are, living in dark and ill-ventilated rooms where the sunlight rarely penetrates, and insufficient and improper food. Children that have been weaned prematurely, or children that have been over-suckled, are very subject to it. Mothers should particularly note that no child should be suckled after the *ninth month;* as the milk after that period is improper for the child, and the suckling is also injurious to herself.

Symptoms. — Children are not born rickety, but the symptoms usually appear between the seventh and twenty-fourth month. The child does not appear well: it is irritable and melancholy, and shuns caresses or attempts to amuse it. It is restless at night, and when it sleeps it perspires freely, so that its night-clothes are quite damp, and the beads of perspiration may be seen standing on its forehead. The child becomes emaciated, and pale and sallow in complexion; but its appetite remains good, and is perhaps a little increased. The bowels are variable, sometimes constipated and sometimes very loose, and the stools are particularly offensive in smell. The quantity of urine is also excessive. There are pains all over the body, and it is from this cause undoubtedly that the child dislikes to be handled and caressed.

When the disease is fully developed, the spine becomes curved, the knees bent, forming what is called "knock-knees," and the child is stunted in growth. The brain, however, does not undergo a corresponding change with the body, and in fact the child frequently appears unusually precocious and clever. Rickets is not in itself fatal, but rickety children are very liable to other diseases, and in this way it is dangerous.

Treatment. — When, from the above-mentioned symptoms, rickets are suspected, immediate precautions ought to be taken, so as to avoid deformity if possible. The child should be kept in an airy, well-ventilated room, and it ought to have a salt-water bath every day. Its diet should be of the most nutritive quality, as beef-tea, milk, etc.; and, if it has teeth, it may be allowed to chew a little meat. It should have its meals at regular intervals, and not be permitted to eat cakes or candy or any such stuff between its meals. The medicines recommended are cod-liver oil, iron, and the phosphates. The elixir of hypophosphites, which may be obtained at any druggist's, is excellent. The state of the child's bowels should be carefully attended to; if the motions are offensive, five grains of Gregory's powder, once or twice a week, may be given with advantage.

There are several surgical appliances used for overcoming the deformities in rickets, such as splints for the legs, etc., which, if not perfectly effecting a cure, yet may greatly reduce the deformity.

Constipation in children, as a rule, is due to want of exercise, and it is for this reason that girls suffer more from costiveness than boys. It is well that parents should bear in mind that constipation may arise from causes which are not only unremovable by purgative drugs, but which might be greatly aggravated by their administration. Rupture, twisting of the bowels, and a condition known as intussusception of the bowel, which is due to slipping of one part of the bowel into the part below, are all comparatively common in children. A teaspoonful of castor oil, or a dose of Gregory's powder, is an efficacious and simple remedy. Friction over the abdomen is often good in chronic constipation. A teaspoonful of ordinary salad oil, the first thing in the morning, also helps to encourage a proper action. Regularity in putting a child to stool is very important. Should light remedies fail, a physician ought to be consulted, as some of the abnormal conditions mentioned above may be present.

Diarrhœa is frequent during the whole period of infancy, and may be due to inflammation of the bowels, or to one of the following causes: Improper food; over-feeding; teething; cold; the mother's milk disagreeing from various causes, namely, her being out of health, from eating unsuitable food, from her taking improper or powerful purgatives, or from her suckling her child when she is pregnant. Worms in the intestines may also operate as a cause.

Symptoms of non-inflammatory diarrhœa may come on suddenly. The evacuations differ much in color and consistence in different cases, and perhaps during separate periods of the same case. In infants they are apt to be green, and this is sometimes a source of great anxiety to the inexperienced. There is no fever in non-inflammatory diarrhœa, and by proper treatment the child soon recovers.

Treatment.—The cause should be looked for, and treated accordingly. A mixture containing paregoric and tincture of catechu, each two drachms, and chalk mixture one ounce, in doses of one to two teaspoonfuls, according to the age, will be found successful in many cases. Of course, if the mother's milk be the cause, it should be stopped and artificial food substituted. Amongst the "Recipes" will be found nutritious articles of diet for children. The subnitrate of bismuth, in five or eight grain doses mixed with sugar, is also very serviceable. Powder of chalk and opium is an excellent medicine, and may be given in doses of three grains, to a child one year old, every three hours.

Inflammatory Diarrhœa is caused by error in diet, or exposure to cold and wet; teething is also one of the exciting causes.

Symptoms.—The disease usually commences with moderate diarrhœa. The number of evacuations at this period does not frequently exceed four to six daily. In a few days after the commencement of the disease, the child begins to vomit, and, in consequence of the vomiting and diarrhœa, the patient becomes pallid, the flesh flabby and soft, and there is considerable emaciation. If there has been fretfulness in the beginning of the sickness, it ceases and the child lies quiet and has an exhausted appearance; and as the disease advances the cheeks become hollow and the eyes sunken.

The tongue at first is moist, and covered with a light fur, but afterwards becomes dry. In the commencement of the disease the skin is hot, but it soon becomes cold if the disease be severe; but the skin is generally dry. During the disease, boils often appear on the forehead and scalp. This disease is very fatal, and a large number of children annually die from it.

Treatment.—The child requires careful nursing. If it occur in an infant of previous good health, and be caused from exposure to cold, its diet should at first be reduced; and, if thirsty, it may be given a little light barley water. Milk should be the principal article of diet at first, and, if vomiting be present, it will be well to mix it with lime-water. Later in the disease the child requires better food, such as a little mutton-broth or beef-tea. Mellin's food may also be prescribed with advantage.

Over the abdomen should be placed warm poultices of flaxseed or linseed meal, and the first one or two may have a little mustard mixed with the meal. The object is not to produce a blister, but only a little redness.

The medicine advised for this condition is the repeated administration of small doses of castor oil. Five drops of castor oil with an equal quantity of gum-water, given in a teaspoonful of cinnamon-water every three or four hours, acts often like a charm. Laudanum sometimes is added to this mixture with advantage, but we cannot recommend it; and, except prescribed by a physician, a child should take no opiate. Another remedy, which is said to have great influence over this disease, is ipecac in the powdered form.

GRIPING in infants is a common occurrence, and may be due to improper food or to over-feeding. If the child be nursing, it can usually be traced to the mother's having eaten greens, pork, or pickles, or having drank sour porter or beer. The use of violent purgatives in the mother also induces in the child griping pains.

Symptoms. — The child draws up its legs and screams violently. If put to the nipple, he turns away and cries bitterly; he strains as though he were having a stool; if he have a motion, it will be slimy, curdled, and perhaps green.

Treatment. — This depends upon the cause: if it arise from over-feeding, a dose of castor oil should be given, and warm fomentations be applied to the bowels. If it proceed from improper food, a mixture composed of powdered Turkey rhubarb, fifteen grains; carbonate of magnesia, twenty grains; simple syrup, three drachms; Dill or anise-water, eight drachms, should be given in doses of one or two teaspoonfuls, according to the age of the child, every four hours until relief be obtained.

CHOLERA INFANTUM, or *Summer Complaint*, is very destructive to young children, in the large cities of this country, during the hot weather.

Causes. — One of the chief causes of this disease is, doubtless, residence in an atmosphere loaded with noxious vapors, especially gases arising from animal and vegetable decomposition; or an atmosphere rendered impure by over-crowding, and by personal or domiciliary uncleanliness. It is, therefore, much more common in tenement houses, and those parts of the city occupied by the poor, than in cleaner and less crowded streets and apartments. In other and probably the majority of cases, another cause coöperates, — namely, the use of improper food, atmospheric heat and its depressing influence acting as the predisposing cause.

Symptoms. — Cholera infantum sometimes commences abruptly, the previous health having been good. In other cases it is preceded by diarrhœa. When the disease has become developed the symptoms are diarrhœa, vomiting, rejection of food, languor, and debility. The disease is characterized by thin, watery stools; they are frequent, and are so thin as to soak the diaper almost like urine. Their odor is peculiar, musty and offensive. Whatever is swallowed is usually vomited up in a few minutes. There is great thirst, cold water especially being taken with avidity; and, if the infant nurses, it eagerly seizes the breast, in order to relieve the thirst. The tongue is usually covered by a moist fur and the head is hot. Loss of strength and emaciation are very rapid; and it is wonderful, the change that takes place after a day or two: the bony angles become prominent, the eyes are sunken, and the eyelids and lips are permanently open. As the disease approaches its fatal termination, which often occurs in two or three days, the infant remains quiet, not disturbed even by the flies which alight upon its face. The body becomes cold, and the eyes bleared, and the child either expires in an insensible condition, or in convulsions.

Treatment. — This is a dangerous disease and requires prompt attention. A spice poultice or plaster should be kept over the abdomen as long as vomiting continues, being renewed frequently, or wet freshly with brandy or whiskey, often enough to maintain its strength. Pounded ice placed in a bag may be given more often than water to quench thirst. The food should be lime-water and milk, farina, arrowroot, chicken-broth, and beef-tea. Later on in the disease a few drops of brandy can be mixed with the food with benefit. The head should be kept cool, if hot, by a light cambric handkerchief wrung out in cold water. The following mixture is often administered with successful results.

Tincture of rhatany, tincture of rhubarb, and paregoric, each one drachm; sugar and gum-arabic, each thirty grains; and cinnamon-water, enough to make two ounces. A teaspoonful should be given every two or three hours.

It is hardly necessary to state that this disease should be treated by a physician.

WORMS. — There are five kinds of worms whose habitat is the human intestines, — (1.) The small white thread or maw worm; (2.) The long round worm; (3.) The long hair-tailed thread-worm; (4.) The tape-worm; (5.) The broad tape-worm.

The thread-worms have usually their seat about the lower bowel, and the round worm in the small intestines or stomach. These two are the ones principally met with in children.

Cause. — Worms appear more frequently in those of a weakly constitution, those whose bowels contain a large quantity of slimy mucus. Those who live on vegetable food, or unhealthy animal meat, as pork, or who eat unripe fruit, or indulge in large quantities of sugary substances, are frequently subject to them; they may also arise from impure water.

Symptoms. — Worms generally produce symptoms of colic, and very frequently other symptoms, as variable appetite, fœtid breath, picking of the nose, hardness and fulness of the belly, sensation of heat and itching of the anus, bad sleep with grinding of the teeth, and starting, crying, etc., during the night.. There is lowness of spirits, the bowels are constipated or loose, and the stool is frequently slimy. The tongue is red, alternately clean and covered with a white, slimy mucus. A short, dry cough is frequently present; and the child gets emaciated, and there is usually a warm skin towards evening. Convulsions, chorea, or fainting fits may occur.

Treatment. — Half a grain of santonine should be taken once or twice daily, until the worm or worms are passed. This, no doubt, is the best remedy that can be used. The infusion of senna and spigelia is a very popular remedy in this country. A half-ounce of each of these substances is added to a pint of boiling water. Dose, a tablespoonful or more, according to the age of the child. Besides these, calomel, bark of the pomegranate root, wormseed, cowhage, male shield-fern, kousso, powdered tin, etc., are used with beneficial results. Thread-worms, which are about the anus, are best treated by keeping the child clean, and injecting into the lower bowel a pint of cold water containing a tablespoonful of tincture of steel, twice a day, until the worms disappear.

MUMPS. — This is characterized by inflammatory swelling of the parotid glands, which are placed below the ears and behind the lower jaw. One or both of the glands may become swollen.

Cause. — Supposed to be due to some atmospheric influence, and is contagious.

Symptoms. — It is generally a mild affection of a few days' duration, the parotid gland swells and becomes hot, painful, and tender to the touch, and some inconvenience in swallowing may result. There is little or no fever, but the child seems irritable and unwell.

Treatment. — Care should be taken that the child does not become chilled. A dose of castor oil may be given if the bowels are costive, and the swelling should be rubbed with a little camphorated oil. If it be very painful, a flaxseed-meal poultice may be applied; and this should always be done if the swelling suddenly leaves the glands and goes to some other part.

DENTITION, OR TEETHING, is hardly to be classed amongst diseases of childhood, considering it is a natural physiological result. Nevertheless the process is often the cause of so much trouble that no excuse need be offered for placing it amongst the diseases. The opinion formerly entertained by the profession, and now prevalent in the community, that a large proportion of the diseases of infancy arise directly or indirectly from teething, is erroneous. There is no doubt, however, that certain troubles originate during the process, such as convulsions, etc.; but to place all troubles, as is often done, occurring during dentition, to the effects of teething, is decidedly wrong, as some other disorder may be overlooked, and the life of the child be imperilled by the oversight. First, dentition commences at the age of about six months, and terminates at the age of two and a half years.

Painful dentition may be divided into two forms,— (1.) The mild; (2.) The severe. In the mild form the child is peevish and fretful, and puts his fingers, and everything within reach, to his mouth; he likes to have his gums rubbed and takes the breast with avidity, and it seems to afford greater comfort to him than ever. There is generally a considerable flow of saliva, and he has frequently a more loose state of the bowels than is his wont.

In the severe form of painful dentition, the gums are red, swollen, and hot, and he cannot, without expressing pain, bear to have them touched. If he is at the breast, he is constantly losing the nipple. He is feverish, restless, and starts in his sleep. His face is flushed. His head is heavy and hot, and he sometimes suffers from convulsions. He is frequently violently griped and purged, and suffers severely from flatulency.

Treatment of the mild form consists of friction of the gums with the finger. The ordinary soothing syrups sold by druggists contain narcotics, and therefore are injurious, and, indeed, often induce convulsions which are attributed to the teeth. A very simple, and at the same time efficacious, soothing syrup may be made by mixing twenty grains of nitre with half an ounce of syrup of roses. The child should be placed in a tepid bath (about 92°) every night at bedtime, and attention must be paid to his diet. He should also be taken out every day for fresh air and exercise. If he dribbles and the bowels be relaxed, so much the better, and nothing need be done to check them, unless they are excessive.

In the mild form, lancing of the gums is not desirable. The gums ought not to be lanced, unless the teeth be near the surface, and the gums be red, hot and swollen.

In the severe form, a medical man should be consulted, as the gums require to be freely lanced.

Taking the child from the city to the country, during severe dentition, will be found often to do more good than any medical assistance.

A child suffering from what is known as tooth-cough should never be given syrup of poppies or paregoric, as it stops the expulsion of the phlegm and often produces convulsions. Some mild remedy, as barley water or flaxseed tea, should be given instead.

An eruption on the skin, especially behind the ears (called eczema), occurs during teething. No application should be made in hopes of curing it, as either convulsions, bronchitis, inflammation of the lungs, or water on the brain may be the consequence. The best plan is to be careful of his diet, and to give him less meat, if he has been accustomed to eat animal food. If the bowels are constipated, a small dose of castor oil should be administered once or twice a week. The rash or eruption should be bathed constantly during the day with a little warm milk and water, or with rose-water.

Earache.—This usually arises from inflammation or the formation of abscesses in the ear. In very young children the presence of earache may be distinguished from stomach-ache by its shrill and continuous screaming, and by its putting its hand to the ear or burying t against the mother's breast.

Treatment. — Immediate relief may be given by putting a few drops of olive oil, mixed with one or two drops of laudanum, into the ear. At the same time warm applications should be made externally, either of a small flannel bag filled with hot salt, or a flannel cloth wrung out of a hot decoction of chamomile and poppy heads.

The application of a roasted onion, enclosed in muslin, to the ear, is an old-fashioned and still favorite remedy.

OTORRHŒA, or *Running from the Ear*, is a common affection amongst scrofulous children, or those who are suffering, or have convalesced, from scarlet fever or measles. It often produces a degree of deafness, which in most instances soon passes off. The running from the ear, however, may continue for months and even years.

Treatment. — The ear should be syringed gently, several times a day, with warm water, after which the following mixture may be injected: Carbolic acid, half a drachm; glycerine, two ounces; water, four ounces.

When the otorrhœa proceeds from scrofula, or during fevers, and when the remedial agents for the fever have been discontinued and the otorrhœa still persists, cod-liver oil and syrup iodide of iron, in doses appropriate to the age of the child, will often be found beneficial for the general health, as well as for the running from the ear.

A piece of "absorbent cotton" should also be placed in the ear to collect the discharge, and prevent it running on the cheek. It will be well to place a few grains of boracic acid in the cotton before its introduction into the ear, and the wad should be changed frequently.

SORE EYES. — There are several varieties of sore eyes, which are occasionally met with in children. The most common affection is that of conjunctivitis, frequently occurring in children of a scrofulous tendency, in which the lid becomes red and inflamed, and matter gathers about the eyelids, so that the eyelids are often glued together in the morning, when the child awakes. A simple remedy for this is to smear the lids with zinc ointment at night, and to wash them with borax and water for two or three days in succession.

There are other and more serious affections of the eyes, indicated by pain and copious watering of the eyes, together with fever and severe inflammation of the eyes. When these symptoms are present, no time should be lost in obtaining medical aid, as permanent injury, or even loss of sight, may be occasioned. It is not possible to give the treatment without observing all the conditions, and the remedies could not be applied by inexperienced hands.

TONGUE-TIE. — This is a condition of the tongue in which the "bridle," or the membrane attaching to the lower part of the tongue, is attached too far forward, thus hindering the free movement of the tongue. In infants, it causes much inconvenience in sucking, in preventing the child's tongue from being placed against the nipple, and in after-life it causes an impediment in the speech.

As soon as this condition of the tongue is observed, an operation should be performed, which consists merely of snipping the "bridle" and releasing the tongue. This operation should only, however, be performed by a physician; for, if any of the blood-vessels around that organ be severed, serious and even fatal hemorrhage may result.

WEAK ANKLES are a frequent source of inconvenience to children. It is chiefly caused by placing the child's foot at too early a time in boots instead of slippers; and, the muscles of the ankles not being brought into action, they are gradually weakened.

In this case, the ankles should be washed daily with salt water, and appropriate shoes should be worn. This will usually suffice to remove the weakness.

KNOCK-KNEES AND BOW-LEGS are due to deformity of the bones of the legs.

Appliances for their relief and cure may be obtained from any surgical-instrument maker.

Bed-Wetting. — This is a very annoying trouble in childhood, and very unhealthy for the child and those who live with it. It usually occurs in children between seven and eight years of age, and appears to be more common in boys than girls.

Treatment. — Great care should be taken that no undue amount of liquid is taken late at night, and that the calls of nature are attended to before going to sleep. Of medicines, small doses of belladonna, in pills one thirtieth of a grain, are serviceable. Moral impressions acting on the child's sense of shame have sometimes much power, but this should be exercised with great care and discretion.

Chafing. — In children, where the folds of skin are in close contact, as in the folds in the groin and neck, they rub together and cause irritation. This chafing is principally caused by want of attention to cleanliness; and therefore the treatment will chiefly consist in washing the inflamed parts carefully, and drying them thoroughly with a soft towel; after this, a little starch, arrowroot, etc., should be dusted over the part.

FOOD FOR THE SICK.

Professor Gross says: "The diet of the sick-room has slain its thousands and tens of thousands. Broths and slops, and jellies, and custards, and ptisans, are usually as disgusting as they are pernicious. Men worn out by disease and injury must have nutritious and concentrated food. The ordinary preparations for the sick are, in general, not only not nutritious, but insipid and flatulent. Animal soups are among the most efficient supporters of the exhausted system, and every medical man should know how to give directions for their preparation. The life of man is his food. Solid articles are of course withheld in acute diseases in their earlier stages."

All animal soups should be made of lean meats; and their nutritious properties, as well as their flavors, may be increased by the addition of some vegetable substance, as rice or barley. If the stomach is very weak, they may be diluted, or seasoned with pepper.

Meat Paste. — Take a piece of raw meat (perfectly free from fat), beef, mutton, or chicken, shred it as fine as possible, and rub it through a sieve so as to form a smooth paste. Mix a piece the size of a pea up with a little cream and sugar. To be given frequently. In cases of extreme exhaustion from diarrhœa or other causes, it is very useful, especially for children. It may be given as a sandwich between thin pieces of bread, if preferred.

Pounded Meat. — Take some chicken, partly but not thoroughly boiled, clear it perfectly from skin, shred it as fine as possible, beat it to a paste in a mortar, with a little of the liquor it was boiled in. Simmer it gently for a few minutes with as much of the liquor as will bring it to the thickness of gruel.

Essence of Beef. — Cut a pound of beef from the rump or sirloin, free from fat, into small pieces, put it into a stone jar with a cover, without any water. Fasten the cover down well with a double bladder. Stand the jar in a saucepan of hot water and simmer for four to six hours. When you take it out you will find about a teacupful of the strongest beef-juice. Give at first a teaspoonful at a time. It is palatable either hot or cold, and so light that it will remain on the stomach when even toast and water is rejected. If preferred as a jelly, a little isinglass may be put in the jar at first with the meat. Salt must be added afterwards.

Beef Tea. — The beef must be very fresh. Take four pounds of the upper side of the round, cut it into small pieces, leave out every bit of fat, put it into a jar with a saltspoonful of salt and three pints of cold water. Tie it closely down, place it in a saucepan of water, and let it boil gently for five hours. The precaution of passing a piece of stale bread over the surface, before serving, should be carefully observed, lest any fat should remain.

Veal Tea. — Cut up into small pieces three pieces of lean veal, put into an enamelled saucepan. with three pints of cold water and a half-teaspoonful of salt. When it boils, skim very carefully. Simmer for three hours. Strain in a basin, and, when cold, remove every particle of fat. When required, pour half a pint, while boiling, on to a teaspoonful of arrowroot which has been mixed with a dessertspoonful of the cold veal-tea.

Chicken Broth — Cut up a fowl and break the leg bones. Put it into a stewpan with a quart of cold water, a teaspoonful of salt, and the same quantity of white sugar. Boil gently, simmering constantly, for four hours. Then strain into a basin. When cold, take off the fat. When required for use, warm a cupful.

Mutton Broth. — Take one pound of scrag of mutton, put it into a saucepan with two pints of cold water and a little salt; let it simmer gently for two hours; strain through a sieve, and, when cold, carefully remove every particle of fat. It may be thickened with a little arrowroot or ground rice, as required.

Flour Gruel. — Tie up one pound of flour tightly in a cloth, place it in a saucepan of cold water, and boil it for four or five hours. When taken out, it will be a hard ball. Pare away the outer rind. When needed for use, scrape off a sufficient quantity, and mix with boiling milk to the thickness of gruel. An excellent food in diarrhœa.

Liebig's Broth. — Chop half a pound of beef, mix it well with a teaspoonful of table salt, four drops (to ten) of muriatic acid, and eighteen ounces of distilled water; macerate for an hour, and strain through a fine hair-sieve. Dose, a teacupful.

Liebig's Food for Infants. — Mix together half an ounce of wheat flour, the same of malt flour, and seven and a quarter grains of bicarbonate of potash, and an ounce of water. Add five ounces of fresh milk, and put the whole upon a gentle fire. When it begins to thicken, take it from the fire, stir it for five minutes, heat and stir again until it becomes quite fluid; finally boil it for a short time. Filter through a sieve to separate the bran; it is then ready for use. It will keep for twenty four hours. Its effect is slightly laxative.

Oatmeal Gruel. — Boil a pint of water in a saucepan; when boiling, mix with it two tablespoonfuls of oatmeal, half a pint of milk, and a little salt. Let it then simmer for half an hour; strain it through a hair-sieve, sweeten, and add a little nutmeg. A few raisins may be added before boiling.

Vegetable Soup. — Put two potatoes, one onion, and a piece of bread into a quart of water; boil down to a pint. Then throw in a little chopped celery or parsley and salt. Cover, remove from the fire, and allow to cool.

Bread and Butter Broth. — Spread a slice of well-baked bread with good fresh butter; sprinkle it moderately with salt and black pepper. Pour a pint of boiling water over it.

Toast Water. — Cut a slice of stale bread half an inch thick, and toast it brown, without scorching. Pour over it a pint of boiling water; cover closely till it cools; then pour off and strain it.

Rice Water. — Take of rice two ounces; water, two quarts. Boil it for an hour and a half, then add sugar and nutmeg to taste. Some prefer salt. An excellent drink in diarrhœa, dysentery, etc.

Arrowroot. — Mix a tablespoonful or a tablespoonful and a half with a little cold water, till it makes a paste. Boil a pint of water, stir in the arrowroot, and boil it a few minutes. Sweeten with white sugar. Brandy or wine may be added if necessary; and half or all *milk* may be used instead of water. A little lemon or orange peel added before boiling will improve the flavor.

Tapioca. — Cover two tablespoonfuls of tapioca with a teacupful or more of cold water, and soak for two or three hours, or over night. Put it then into a pint of boiling water, and boil until it is clear and of the desired consistence. Sugar, nutmeg, or wine, etc., may be added as required.

Isinglass. — Isinglass may be added to the invalid's tea night and morning.

Sago Jelly. — Mix well together four tablespoonfuls of sago, the juice and rind of one lemon, and a quart of water. Sweeten to taste, let it stand half an hour, and boil it, stirring constantly, until clear. Then add a wineglassful of wine; currant wine will do.

Wine Whey. — Boil half a pint of milk, and, while boiling, add a wineglass of Madeira or sherry wine. Separate the curd by straining through muslin or a sieve. Sweeten the whey to taste, and grate upon it a little nutmeg.

Egg and Wine, or Brandy. — Beat up a raw fresh egg, and stir with it two tablespoonfuls of wine, or one of brandy. Sweeten or not, according to taste.

Caudle. — Beat up a raw egg with a wineglassful of sherry, and add to it half a pint of hot gruel. Flavor with lemon-peel, nutmeg, or sugar.

Milk Punch. — Into a tumblerful of milk put one or two tablespoonfuls of brandy, whiskey, or Jamaica rum. Sweeten, and grate nutmeg on top.

Ferruginous Chocolate. — Mix sixteen ounces of chocolate with half an ounce of carbonate of iron. Divide the mass into cakes of one ounce each. One may be dissolved in half a pint of hot milk, to be taken night and morning.

Calves' Feet. — Take two calves' feet, two pints of water, one pint of new milk and a little lemon-peel or mace. Put the ingredients into a jar, cover it down, and keep it in the oven for four hours. When cold, remove the fat. Good the first thing in the morning, or at night.

Savory Custard — A savory custard, much relished by sick people, is made in the following manner: Take the yolks of two eggs and the white of one, and put in a small basin; add one gill of beef-tea, and a quarter of a saltspoonful of salt; whip up the eggs and the beef-tea; take a small cup which will hold the mixture, and butter it; take a piece of white letter-paper, and butter that, and tie it on the cup; have a saucepan with hot water, and put it on the fire to boil; when the water is boiling, put in the cup so that the water stands below the top of the cup; let it simmer for a quarter of an hour; serve hot.

Cooling Drinks. — Take sugar, two or three lumps; lemon, one. Rub well the sugar on the rind of the lemon, squeeze out the juice, and add to it half a pint or a pint of *cold* or *iced water*, or, better still, one or two bottles of *soda-water.*

Imperial Drink. — Put half an ounce of cream of tartar, the juice of one lemon, and two tablespoonfuls of sifted sugar into a jug, and pour over them one quart of boiling water. Cover till cold. Excellent in cases of dropsy.

For further information as regards the preparation of food, see article on "Household."

PRESCRIPTIONS, ETC.

Cathartics or Purgatives are medicines which loosen the bowels.

The constant use of purgatives is injurious, and the purgative action is followed by a greater or less amount of costiveness.

1. *A Saline Purgative good in Acute Constipation, or in the Onset of Pneumonia, Pleurisy, etc.:* —

℞ Epsom salts, three drachms; fluid extract of senna, one fluid drachm; syrup of ginger, half a fluid ounce; water enough to make two fluid ounces.

Mix, and take the whole in the evening.

2. ℞ Powdered rhubarb-root, twenty-four grains; aloes, ten grains; myrrh, twelve grains; oil of peppermint, two drops.

Mix and divide into pills (No. 12).

Dose: One as required.

3. *Habitual Constipation :* —

℞ Resin of podophyllum, two grains ; alcohol, one ounce.
Dose : Teaspoonful in a glass of water at bedtime.

4. ℞ Castor oil, half an ounce ; milk, half a cupful.
Mix well together. The milk removes the unpleasant taste of the oil.

5. ℞ A bottle of the citrate of magnesia.
Dose : Half at night, and the remainder in the morning, if the bowels have not acted.

Injections or Enemas. — These are liquid substances thrown into the lower bowel, and may be used in place of purgatives by the mouth, or as astringents to check diarrhœa, or to stop bleeding from the bowels.

Nutrient injections are also given to nourish the patient in exhausted conditions where food cannot be given by the mouth.

6. ℞ Castor oil, half an ounce ; molasses, half an ounce ; soapsuds, one pint.
Mix well and inject.

7. *To check Purging of Consumptives, or Dysentery :* —

℞ Bismuth, subnitrate, twenty-four grains ; laudanum, twenty drops ; mucilage of starch, one ounce. Mix and inject.

8. *To check Bleeding from the Bowels :* —

℞ Spirits of turpentine, thirty drops ; mucilage of starch, one ounce. Mix and inject.

9. ℞ Cold iced water injected also prevents bleeding, especially from piles.

10. Cooling Lotions, used to subdue inflammation and relieve pain : —

℞ Nitre, half an ounce ; sal ammoniac, two drachms ; vinegar, three tablespoonfuls ; camphor-water, one pint. Mix.

This solution is applied by means of sponges or cloths to the head and elsewhere.

11. ℞ Laudanum, one drachm ; spirits of rosemary, one drachm ; diluted lead-water, one ounce. Mix. Apply by means of cloths soaked in the solution.

Good in irritable ulcers, chilblains, etc.

12. Counter-Irritants. — Counter-irritants are applications to irritate one part of the body to relieve disease in another.

℞ Croton oil, thirty drops ; olive oil, two tablespoonfuls. Mix.

When rubbed on, produces redness and eruption of the skin. A useful application to the chest in the beginning of consumption.

13. ℞ Tincture of iodine, alcohol, equal parts.

To be applied with a camel's-hair brush, in cases of persistent pains in the joints and limbs.

Blisters and Cups have the same effect.

Cupping is performed as follows : —

Take a tumbler or wineglass and a little piece of cotton or paper, which is to be wet with the spirits of wine, set on fire, and thrown into the glass ; the rim of the glass should be then at once firmly pressed down over the skin, when the fire will be quickly extinguished, and the skin drawn up forcibly into the glass. By making small incisions before applying the glass, blood is drawn.

Cups are useful in cases of pneumonia and congestion of the brain. In the latter case, the back of the neck should be cupped ; and, in congestion of the kidneys, over the lower part of the back.

Leeching, being somewhat less violent, is more applicable than cupping to parts which are very tender, as the side in acute pleurisy, the abdomen in peritonitis, a much-inflamed joint, etc.

How to get Leeches to fix: —

Clear the skin carefully of all perspiration, and, if they do not readily take hold, moisten it with a little sweetened water or milk.

After the application of leeches, they should be left alone until they drop off. The part should be then dusted over with a little flour. If it bleeds freely it may be stopped by pressure, or ice applied. If this fails, vinegar and alum may be used.

Leeches should not be applied to the eyelids or face, as they leave scars. In children, great caution is required in their use.

14. **Emetics** are medicines used to produce vomiting. Their action is promoted by drinking freely of warm water.

Mustard Emetic: —

℞ Teaspoonful of mustard flour in a teacupful of warm water.
To be taken every ten minutes until vomiting is produced.

15. *Salt Emetic:* —

Two teaspoonfuls of common salt in a teacupful of warm water.
To be taken every ten or fifteen minutes until vomiting is produced.

16. *Emetic of Alum and Ipecac:* —

Powder of ipecacuanha and powder of alum, each half a teaspoonful. Mix with water. Repeat in ten minutes if it does not vomit.

Good in threatening croup.

Eye-Washes. — *In Weak Eyes:* —

17. ℞ Common salt, one drachm; warm water, one pint. Mix and wash the eyes well. Or, —

18. ℞ Sulphate of zinc, two grains; alcohol, ten drops; pure water, one ounce. Mix.
A few drops to be placed under the eyelids twice a day.

For Inflammation of the Eye: —

19. ℞ Borax, one teaspoonful; water, one pint. Mix.
Wash the eyes well three or four times a day.

20. ℞ Tincture of arnica, five drops; pure water, one ounce. Mix.
Often of benefit in weak and sore eyes.

Fomentations, or Stupes, are used to relieve pain, especially of the bowels.

21. *Turpentine Fomentation:* —

Steep a piece of linen in oil of turpentine, and place it over the part; hot flannels should be placed over it, and changed constantly. Or, —

22. Sprinkle a flannel, wrung out of hot water, with a tablespoonful of turpentine.

23. Laudanum may be used in place of turpentine, or they may be mixed.

24. *Mustard Fomentation:* —

Add a quarter of a pound of mustard to a pint of boiling water. Wring the flannel out in this solution.

25. **Gargles.** — ℞ Chlorate of potash, one teaspoonful; glycerine, two tablespoonfuls; water, a tumblerful. Mix.
For ordinary sore throat.

26. ℞ Sage, two ounces; linseed, one ounce; boiling water, one pint. Mix.
To be used when cold.

27. ℞ Alum, two teaspoonfuls; water, tumblerful. Mix.
Used to remove offensive breath.

28. ℞ Tincture of guaiacum, two ounces; chlorate of potash, two drachms; glycerine, two ounces; water, one pint. Mix.

An excellent gargle in enlarged tonsils, etc.

29. Medicinal Teas, etc. — *To act on the Skin.*

℞ Pipsissewa, bruised, one ounce, water, one pint. Boil for fifteen minutes, strain, and add sufficient water through the strainer to make the tea measure a pint.

Dose: Wineglassful every two or three hours.

30. *To act as a Tonic:* —

℞ Red or yellow cinchona-bark, one ounce; water, one pint. Boil for fifteen minutes, strain, and add sufficient water through the strainer to make the tea measure one pint.

Dose: Wineglassful three times a day before meals.

31. *In Skin Diseases and Gravel:* —

℞ Goose-grass, a handful; water, one quart. Boil for twenty minutes.

Dose: A tumblerful three times a day.

32. *To improve the Appetite:* —

℞ Dogwood, bruised, one ounce; water, one pint. Boil for fifteen minutes, strain, and add sufficient water through the strainer to make the tea measure a pint.

Dose: Wineglassful three times a day before meals.

33. *For Diarrhœa:* —

℞ White-oak, bruised, one ounce; water, one pint. Boil for half an hour, strain, and add sufficient water through the strainer to make the tea measure a pint.

Dose: Wineglassful every three or four hours.

34. *For Coughs and Colds:* —

℞ Iceland moss, half an ounce; water, one pint. Boil for fifteen minutes, strain with squeezing, and add sufficient water through the strainer to make the tea measure a pint.

Dose: Wineglassful every three or four hours.

35. *To act on the Liver in Biliousness:* —

℞ Dandelion root, sliced and bruised, one ounce; water, one pint. Boil for ten minutes in a covered vessel, strain as above, and add sufficient water to make a pint.

Dose: A wineglassful three or four times a day.

36. *For Dropsies:* —

℞ Bruised juniper berries, one ounce; infuse for two hours in a pint of hot water; pour off, and add a tablespoonful or two of cream of tartar; stir, and drink in portions through the day.

37. *For Worms:* —

℞ Leaves of senna and root of spigelia, each half an ounce; boiling water, a pint and a quarter; infuse, covered, for two hours.

Dose: A wineglassful morning and night.

38. Liniments, used to remove pain and swelling: —

℞ Camphor, one ounce; olive oil, four ounces. Rub up the camphor in the oil.

39. ℞ Camphor and chloral hydrate, equal parts. Rub well together.

Useful in neuralgia, etc.

40. ℞ Pure chloroform, three ounces; olive oil, four ounces. Mix well.

Useful in neuralgia and rheumatism.

41. ℞ Oil of mustard, one drachm; extract belladonna, one drachm; camphor, two drachms; castor oil, five drachms; alcohol, four ounces. Mix.

In pains of the joints, etc.

Lotions, or Washes, are employed either for soothing or cooling inflamed parts, for stimulating chronic sores, etc

42. *For Sprains and Bruises:* —

℞ Tincture of arnica, half an ounce; water, a tumblerful. Mix.

43. *For Sluggish Sores:* —

℞ Sal ammoniac, one drachm; laudanum, one tablespoonful; water, a tumblerful. Wash three or four times a day.

44. ℞ Vinegar and water, equal parts. Given in old sores, to wash constantly.

45. Ointments and Salves. *Chapped Hands and Face:* —

℞ Bay-rum and glycerine, each, half an ounce; quince-juice jelly, one ounce. Mix.

46. *Skin Diseases and Offensive Sores and Feet:* —

℞ Boracic acid, two drachms; almond oil, one drachm; white wax, one drachm; vaseline, enough to make one ounce. Mix.

47. *For Piles:* —

℞ Tannic acid, one drachm; powdered opium, one drachm; lard, fresh, one ounce. Mix.

48. Poultices. *Bread Poultice.*— Scald out a basin, then immediately put in some boiling water, and throw into it coarsely crumbled bread. Cover the basin with a plate. When the bread has soaked up as much water as it will imbibe, drain off the remainder, and there will be left a light pulp. Spread it a third of an inch thick on folded linen, and apply it when at the temperature of a warm bath. — *Abernethy.*

49. *Linseed-Meal Poultice.* — Get some linseed powder, not the common stuff full of grit and sand Scald out a basin. Pour in some perfectly boiling water; throw in the powder; stir it round with a stick till well incorporated; add a little more water, and a little more meal; stir again, and, when it is two thirds the consistency you wish it to be, beat it up with the blade of a knife till all the lumps are removed. Then take it out and lay it on a piece of soft linen, spread it the fourth of an inch thick, and as wide as will cover the whole inflamed part. Put a piece of hog's lard in the centre of it, and, when it begins to melt, draw the edge of a knife lightly over, and grease the surface of the poultice. — *Abernethy.*

50. *Mustard Poultice.* — Mix the mustard with cold water, and knead it to the consistence of putty. Spread it the eighth of an inch thick upon brown paper or linen, warm it before the fire, and apply it to the part affected, putting a *thin* piece of muslin between it and the skin.

51. *Bran or Hop Poultice.* — Fill a bag one third full with bran, or hop flowers, moistened but not thoroughly wetted with boiling water. Shake the bag and hold it before the fire till it is thoroughly hot, and then apply it to the affected part.

52. *Bryony Poultice for Bruises, such as Black Eye.* — A poultice, made of black bryony-root (deprived of its bark, and finely scraped) and bread-crumbs or flour, should be enclosed in a muslin bag, and applied over the injured part. It will cause the ecchymosis or blackness to disappear within twenty-four hours. —*Tyrrell.*

Tonics. — To improve the digestion and give tone to the system.

53. ℞ Tincture of iron, five and a half drachms; quinine sulphate, one drachm; glycerine, one ounce; water, enough to make four ounces. Mix.

Dose: Teaspoonful in water three times a day.

54. ℞ Quinine sulphate, twelve grains; reduced iron, one drachm; extract of nux-vomica, three grains. Mix, and divide into twelve pills.

Dose: One, three times a day.

55. ℞ Sulphate of iron, one drachm; Epsom salts, eleven drachms; dilute of sulphuric acid, five drachms; peppermint-water, enough to make four ounces.

Dose: Teaspoonful three times a day.

To improve the Appetite: —

56. Equal parts of tincture of gentian and columbo.
Dose: Dessertspoonful three times a day before meals.

Indigestion or Weak Stomach. — Also in chronic congestion of the liver.

57. ℞ Pepsin, two drachms; dilute nitro-muriatic acid, half an ounce; tincture of nux-vomica, half an ounce; syrup of orange-peel, two ounces; water, enough to make six ounces. Mix.
Dose: Teaspoonful three times a day, after meals.

In Neuralgia: —

58. ℞ Croton chloral, twenty grains; tincture digitalis, forty drops; syrup of orange-peel, one ounce; water, three ounces. Mix.
Dose: One ounce every three hours until relieved. Or, —

59. ℞ Sal ammoniac, forty grains; water, four ounces. Mix.
One ounce every hour in water until relieved.

60. *For Colic:* —

℞ Spiced syrup of rhubarb; tincture of cardamom; paregoric and cinnamon-water, each a fluid ounce. Mix.
Dose: Tablespoonful. May be repeated in an hour if not relieved.

61. *Rheumatism Mixture:* —

℞ Iodide of potash, carbonate of potash, each two drachms; wine of colchicum, half an ounce; water enough to make three ounces. Mix.
Dose: Teaspoonful three times a day.

62. *Neuralgic Headache:* —

Squeeze the juice of a lemon in a small cup of strong black coffee.

63. *To produce Sleep:* —

Chloral hydrate, fifteen grains; syrup of orange-peel, half ounce. Mix.
Take at bedtime.

64. *To quiet the Nerves after Drinking:* —

Bromide of potash, thirty grains; aromatic spirits of ammonia, thirty drops; syrup of orange-peel, half an ounce.
Mix, and take with plenty of water.

WASHES. *Stimulating Hair-wash:* —

℞ Aromatic spirits of ammonia, one ounce; spirits of rosemary, one ounce; tincture of cantharides, three drachms; glycerine, half an ounce; rose-water enough to make eight ounces. Mix.
To be rubbed on well twice a day.

Wash for the Mouth: —

℞ Chlorate of potash, one drachm; tincture of myrrh, one ounce; rose-water, six ounces. Mix.

Removal of Dandruff from the Hair: —

Carbonate of potash, half an ounce; alcohol, one ounce; water enough to make eight ounces. Mix.
Use little at a time: rub well into scalp until it forms a lather.

DISINFECTANTS

Are substances possessing the power of destroying germs of diseases, and which also, by absorbing or decomposing impure gases, purify the atmosphere.

I. Fresh Air and Sunlight.

II. Water. — Dishes of water placed in a room will absorb impure gases. Care should be taken to change the water frequently.

A pailful of water placed in a freshly painted room will remove the disagreeable odor of the paint.

III. Charcoal. — Powdered charcoal is very efficacious in absorbing foul odors; it should be exposed in open pans.

IV. Fresh Earth. — Fine dry earth sprinkled over offensive matters, or placed in boxes about a room, is also efficacious in absorbing foul odors.

V. Sulphate of Iron, or copperas, in powder alone or mixed with lime, is an excellent disinfectant for privy-wells, slaughter-houses, ditches, etc. Or, charcoal, two ounces; sulphate of iron (copperas), forty ounces; sulphate of lime (plaster or gypsum), fifty ounces; sulphate of zinc (white vitriol), seven ounces. Mix well and scatter dry, or mix with water.

VI. Chloride of Lead. — Dissolve half a drachm of nitrate of lead in a pint of boiling water, and two drachms of common salt in a pail of water. Mix the two solutions and allow the sediment to settle.

A cloth dipped in the liquid and hung up in an apartment is all that is required to purify the most fetid atmosphere. It also can be thrown down sinks, drains, etc.; good also to wash infected clothes in.

VII. Carbolic Acid. — Impure carbolic acid, one ounce; water, one gallon. Mix and sprinkle over the floors of privies, about sinks, etc.

VIII. Red Clay mixed with a four per cent solution of sulphuric acid, and a little carbolic acid, is also a good disinfectant.

IX. Chloride of Lime is often deleterious, in close dwellings, from the amount of chlorine gas evolved; but it is excellent for drains, ditches, etc. By adding vinegar or diluted sulphuric acid with it, the amount of chlorine gas is increased.

X. Common Salt, three ounces; black oxide of manganese and oil of vitriol, each one ounce; water, two ounces. Mix in a cup, and carry it through the apartments of the sick; but it should not be left in the room.

How to fumigate Rooms.

I. Heat a common iron shovel quite hot, and pour vinegar slowly upon it. The windows and doors should be open at the time, as the fumes of vinegar are very irritating.

II. Sulphurous Acid Gas. — Another way to fumigate rooms is with sulphur fumes. Take two ounces of sulphur and place it in a kettle, close every window, kindle the sulphur, and immediately leave the room; the door should be locked and no one allowed to enter it for eight hours, after which time the doors and windows may be thrown open.

III. Chlorine Gas, Bromine, or nitrous-acid fumigation should only be used by persons acquainted with such gases, as they are very poisonous.

IV. Another very efficacious disinfectant (in washing furniture, books, clothing, etc., which have remained in the room of a person suffering from infectious diseases) is made by mixing one part of rectified oil of turpentine, seven parts of benzine, with the addition of five drops of the oil of verbena to each ounce. This forms the peroxide of hydrogen, a powerful oxidizing agent, similar to ozone. — *British Medical Journal.*

V. Clothing may be disinfected by placing in a hot oven, or boiling it.

VI. To remove the unpleasant odor from a room quickly, burn in it dried lavender or cascarilla bark. The window should be opened when it is done. Roasting coffee has the same effect.

Precautions in Visiting Infected Rooms.

Never enter an infected room on an empty stomach. Stay only as long as it is necessary. Breathe lightly while there. On returning home, take a warm bath, and rub the skin well when drying.

MATERIA MEDICA.

Materia Medica is that department of medical science whose office is the description and action of substances found in nature, or artificially prepared, which are capable of exerting a sensitive impression on the human system.

There are many thousands such substances known, but we have selected and placed in a tabulated form only those that are most commonly used.

The definition of the terms used to denote their action is as follows: —

Astringents act on the muscular tissue, causing its contraction. They are used in hemorrhage, diarrhœa, etc.

Anthelmintics destroy worms, or expel them from the bowels.

Alteratives change the morbid or unhealthy actions or states of the system.

Antispasmodics give relief to spasms, and allay nervous irritation.

Antiphlogistics counteract, in the most direct way, all inflammatory processes, and are for that reason used in inflammatory fevers, etc.

Antacids neutralize acids, whether in the stomach, intestines, or circulating in the blood, as occurs in rheumatism, gout, etc.

Antiperiodics have a peculiar influence over diseases which have a periodic tendency, as malarial fevers, etc.

Antirheumatics have an influence over rheumatic troubles.

Antiscorbutics are medicines which counteract blood deteriorations, caused by scurvy, etc.

Antiscrofulitics are used in scrofulous diseases.

Antidyspeptics improve the condition of the digestive organs, and relieve dyspepsia.

Antiemetics prevent vomiting.

Antiarthritics are medicines which subdue an influence in the blood which gives rise to diabetes, gravel, or diseases of the joints.

Anticonvulsives correct certain convulsive disorders, dependent upon blood deterioration.

Antipyretics are medicines which reduce the temperature of the body during fevers.

Absorbents absorb poisonous or irritant substances. Are used in diarrhœa, vomiting, etc.

Antiseptics are substances which prevent putrefaction.

Aromatics are medicines having a spicy smell, and are used for their pleasant odor; also in conjunction with purgatives to prevent griping.

Anodynes are medicines used for the relief of pain.

Cathartics act on the bowels, producing a purgative effect. Drastic cathartics act rapidly and violently on the bowels, and occasion considerable pain. Hydragogue cathartics produce a watery discharge from the bowels.

Carminatives cause expulsion of wind or flatus from the stomach or intestines.

Caustics are used externally to remove abnormal growths, and have the power of burning or destroying animal tissue.

Cholagogues stimulate the action of the liver and increase the flow of bile.

Demulcents soften or soothe irritated surfaces.

Diaphoretics act on the skin, increasing perspiration.

Diuretics act on the kidneys, producing an increased flow of urine.

Deliriants are substances having a sedative action over the heart and circulation.

Emetics are substances which induce vomiting.

Escharotics are substances which destroy animal tissues; they are similar to caustics, only more powerful.

Febrifuges have the power of checking fever.

Expectorants promote the flow and ejection of fluids from the lungs.

Hæmastatics, when taken internally, contract the blood-vessels and check hemorrhage or bleeding.

Hypnotics produce sleep.

Laxatives are similar to cathartics, but their action is much milder.

Narcotics are poisonous substances acting principally on the brain, either as a sedative or stimulant.

Sudorifics are substances which induce a moist condition of the skin.

Soporifics are medicines of a mild nature for inducing sleep.

Sedatives are medicines which have a sedative or calming effect on the nervous system.

Stomachics and stomachic tonics are medicines which improve the tone of the stomach and appetite.

Refrigerants allay heat, especially that of the skin.

Stimulants are substances which exalt nervous force in general, and invigorate the circulation of the blood.

Tonics are substances which moderately and permanently improve the general health.

English Name.	Latin Name.	Part of the Plant used, or Appearance of the Salt or Liquid.	Action.
Acetic acid.	Acidi acetici.	Colorless liquid.	Refrigerant.
Aqua-fortis.	Acidi nitrici.	" "	Refrigerant, tonic, astringent.
Alum.	Alumenis.	Large white crystals.	Astringent, laxative, emetic.
Aloes.	Aloes.	Dried juice.	Tonic, cathartic, anthelmintic.
Arnica.	Arnica.	Flowers and root.	Narcotic, stimulant, diaphoretic.
Arsenic.	Arsenicum.	Salts used.	Nervine tonic and alterative.
American Ivy.	Ampelopsis quinquefolia.	Bark and twigs.	Alterative, tonic and expectorant.
Almonds.	Amygdala.	Fruit.	Demulcent.
Assafœtida.	Assafœtida.	Dried juice.	Antispasmodic and expectorant.
Aconite.	Aconitum.	Leaves and root.	Narcotic, sudorific, antiphlogistic.
Butternut.	Juglans.	Inner bark of root.	Laxative and cathartic.
Baking soda.	Sodii bicarbonis.	White powder.	Antacid and cholagogue.
Bark.	Cort. cinchonæ.	Bark.	Tonic and antiperiodic.
Bismuth.	Bismuthi subcarbonis.	White powder.	Antispasmodic and absorbent.
Bromide.	Potassii bromidi.	White crystals.	Nervous sedative.
Bryony.	Bryonia.	Root.	Hydrogogue cathartic.
Bitter cucumber.	Colocynthis.	Fruit.	Cathartic.
Benzoin.	Benzoinum.	Dried juice.	Antispasmodic and expectorant.
Benzoic acid.	Acidi benzoici.	White crystals.	Antispasmodic and diuretic.
Balsam of Tolu.	Balsami Tolutani.	Juice.	Tonic and expectorant.
Black Hellebore.	Helleborus.	Root.	Hydragogue cathartic.
Blue-pill.	Pilulæ hydrargyri.	Blue mass.	Alterative and cathartic.
Blood-root.	Sanguinaria.	Rhizome.	Alterative and expectorant.
Blackberry.	Rubus.	Root.	Astringent and stomachic tonic.
Borax.	Sodæ boratis.	Large white crystals.	Astringent.
Brandy	Spiritus vini gallici.	Brown liquid.	Stimulant.
Citric acid.	Acidi citrici.	White crystals.	Antiscorbutic, antipyretic, and refrigerant.
Calabar bean.	Physostigma.	Seeds.	General sedative.
Colombo.	Calumba.	Root.	Stomachic tonic.
Camphor.	Camphora.	Concrete oil.	Antispasmodic, diaphoretic, stimulant.
Cream of tartar.	Potassæ bitartratis.	White crystals.	Diuretic, refrigerant, cathartic.
Charcoal.	Carbo.	Black powder.	Antacid and absorbent.
Castor oil.	Olei ricini.	Thick, colorless liq'd.	Laxative.
Croton oil.	Olei tiglii.	Reddish liquid.	Cathartic.
Catechu.	Catechu.	Extract.	Astringent and tonic.
Chamomile.	Anthemis.	Flowers.	Antispasmodic, stomachic tonic.
Chloral.	Chloral hydratis.	Silky crystals.	Antispasmodic, hypnotic, sedative.
Cod-liver oil.	Olei morrhuæ.	Pale-brown liquid.	Nutritive and tonic.
Chalk.	Calx.	White powder.	Absorbent and antacid.
Canada balsam.	Balsami Canadensis.	Thick yellow liquid.	Same as turpentine.
Coltsfoot.	Tussilago.	Whole herb.	Expectorant and demulcent.
Calomel.	Hydrargyri chloridi mitis	White powder.	Alterative, cholagogue and purgative.
Chlorate of potash.	Potassii chloratis.	White crystal.	Astringent, diuretic, and tonic.
Cascarilla.	Cascarilla.	Bark.	Stomachic tonic and astringent.
Creosote.	Creosotum.	Thick colorless liquid.	Antiseptic, astringent, absorbent.
Cloves.	Caryophyllus.	Unexpanded flowers.	Aromatic, stimulant, stomachic.
Cow itch.	Mucuna.	Hairs of the pods.	Anthelmintic.
Caraway.	Carum.	Seeds.	Aromatic, carminative, stimulant.
Clover, red.	Trifolium pratense.	Whole herb.	Alterative and diuretic.
Dover's powder.	Pulvis Doveri.	Yellowish powder.	Astringent, diaphoretic, hypnotic, etc.
Deadly nightshade.	Belladonna.	Leaves and root.	Diuretic, diaphoritic, heart tonic
Dog-grass.	Triticum repens.	Root.	Diuretic.
Dandelion.	Taraxacum.	"	Cholagogue, diuretic and tonic.
Donoven's solution.	Liq. arsenici et hydrarg iodidi.	Pale yellow liquid.	Alterative and tonic.
Dogsbane.	Apocynum andro sæmifolium.	Root.	Alterative and diaphoretic.
Epsom salts.	Magnesiæ sulphatis.	White crystals.	Tonic cholagogue and purgative.

English Name.	Latin Name.	Part of the Plant used, or Appearance of the Salt or Liquid.	Action.
Ergot of rye.	Ergota.	Diseased seed.	Stimulant, narcotic, hæmastatic.
Fleabane.	Erigeron.	Whole herb.	Tonic, diuretic, and astringent.
Fever-tree.	Eucalyptus globulus.	Leaves.	Antiperiodic and febrifuge.
Foxglove.	Digitalis.	"	Diuretic and heart tonic.
Friar's balsam.	Tinct. Benzoini co.	Thick colorless liquid.	Antispasmodic, antiseptic, and expectorant.
Fowler's solution.	Liq. potassii arsenitis.	Reddish liquid.	Alterative.
Goulard's extract.	Liq. plumbi subacetalis.	Colorless liquid.	Used externally as a lotion (diluted).
Glauber's salts.	Sodæ sulphatis.	White crstals.	Purgative.
Gentian.	Gentiana.	Root.	Tonic and stomachic.
Goldenseal.	Hydrastis Canadensis.	"	Alterative, laxative, cholagogue.
Ginger.	Zingiber.	Rhizome.	Aromatic, carminative, stimulant.
Grey powder.	Hydrargyri cum cretæ.	Gray powder.	Alterative and cathartic.
Gallic acid.	Acidi Gallici.	Brown crystals.	Astringent and hæmastatic.
Goldthread.	Coptis.	Root.	Bitter tonic.
Hemlock.	Conium.	Leaves.	Antispasmodic, general sedative.
Henbane.	Hyocyamus.	Seeds and leaves.	Antispasmodic, hypnotic, sedative.
Hops.	Humulus.	Strobiles.	Tonic, hypnotic, and stimulant.
Horehound.	Marrubium	Whole herb.	Diuretic, diaphoretic, expectorant.
Hypophosphites.	Hypophosphites.	White powder.	Antiseptic and nervine tonic.
Horse-radish.	Monarda.	Root.	Carminative and stimulant.
Indian hemp.	Cannabis Indica.	Flowers.	Antispasmodic and anodyne.
Iodine.	Iodinium.	Black scales.	Alterative, antirheumatic, and antiscrofulitic.
Iodoform.	Iodoformi.	Yellow powder.	
Iodide of potash.	Potassii iodidi.	White crystals.	
Ipecac.	Ipecacuanha.	Root.	Diaphoretic, expectorant, emetic.
Iron.	Ferrum.	Salts used.	Astringent and tonic.
Lard.	Adeps.		In ointments.
Jalap.	Jalapa.	Root.	Cathartic.
Lavender.	Lavandula.	Flowers.	Carminative and stimulant.
Lactic acid.	Acidi lactici.	Colorless liquid.	Antidyspeptic.
Lime-water.	Aquæ calcis.	" "	Antiemetic and antacid.
Lead.	Plumbum.	Salts used.	Astringent.
Lettuce.	Lactucarium.	Flowering herbs.	Soporific, sedative, for children.
Liquorice.	Glycyrrhiza.	Root.	Laxative and expectorant.
Lime.	Calx.	Salts used.	Antacid and astringent.
Logwood.	Hæmatoxylon.	Wood.	Astringent.
Lunar caustic.	Argenti nitratis.	White sticks.	Astringent and caustic.
Leopardsbane.	Aconitum.	Leaves and root.	See "Aconite."
Muriatic acid.	Acidi hydrochlorici.	Straw-colored liquid.	Tonic and antidyspeptic.
Monkshood.	See "Aconitum."		
Meadow saffron.	Colchicum.	Root and seeds.	Antiarthritic, diuretic, sedative.
Male fern.	Filix mas.	Rhizome.	Anthelmintic.
Marshmallow.	Althæa.	Root.	Demulcent.
Milkweed.	Asclepias syriaca.	Whole plant.	Anodyne and expectorant.
Magnesia.	Magnesium.	Salts used.	Antacid and cathartic.
Mustard.	Sinapis.	Seeds.	General stimulant and emetic.
Mandrake.	Podophyllum.	Fruit and root.	Alterative, cholagogue, cathartic.
Manna.	Manna.	Dried juice.	Laxative.
Nitrate of amyl.	Amyl nitratis.	Colorless liquid.	Used in asthma and spasm of the heart.
Nux vomica.	Nux vomica	Seeds.	Stimulant and general tonic.
Opium.	Opium.	Dried juice.	Anodyne, narcotic, antispasmodic, etc.
Oil of vitriol.	Acidi sulphurici.	Thick colorless liquid.	Escharotic, astringent, and tonic.
Ox bile.	Fel bovinum.	Concentrated bile.	Laxative.
Prussic acid.	Acidi hydrocyanici.	Colorless fluid.	Violent poison, sedative, and antispasmodic.
Pulsatilla.	Anemone pratensis.	Dried herb.	Alterative.
Pepper, red.	Capsicum.	Fruit.	Tonic and stimulant.
Port wine.	Vini Portense.	Reddish liquid.	Stimulant and astringent.

English Name.	Latin Name.	Part of the Plant used, or Appearance of the Salt or Liquid.	Action.
Pleurisy-root.	Asclepias tuberosa.	Root.	Cathartic, diuretic, diaphoretic, and expectorant.
Pink-root.	Spigelia.	“	Anthelmintic.
Pumpkin-seeds.	Pepo.	Seeds.	“
Phosphoric acid.	Acidi phosphorici.	Colorless liquid.	Antiscorbutic and nervine tonic.
Pipsissewa.	Chimaphila.	Leaves.	Alterative, diuretic, tonic, and astringent.
Pomegranate.	Granati.	Rind and root bark.	Astringent and anthelmintic.
Quassia.	Quassia.	Wood.	Stomachic tonic.
Quinine.	Quinia.	White silky crystal.	Antiperiodic, antipyretic, tonic.
Rhubarb.	Rheum.	Root.	Astringent, purgative, and stomachic tonic.
Rum, bay.	Spiritus myrciæ.	Brownish liquid.	Used externally.
Rhatany.	Krameria.	Root.	Astringent.
Slippery elm.	Ulmus.	Inner bark.	Demulcent.
Saltpetre.	Potassæ nitratis.	White crystals.	Diuretic and refrigerant.
Solomon's seal.	Convallaria polygonatum.	Root.	Astringent, tonic, and diaphoretic.
Strychnia.	Strychnia.	Silky crystals.	Tonic and nervine stimulant.
Sal ammoniac.	Ammoniæ muriatis.	Square lump.	Diuretic and expectorant.
Sal volatile.	Aquæ ammoniæ.	Colorless liquid.	Stimulant, antacid, antispasmodic.
Sarsaparilla.	Sarsaparilla.	Root.	Alterative, diuretic, demulcent.
Seneka.	Senega.	“	Diuretic, diaphoretic, expectorant.
Squills.	Scilla.	Bulb.	Diuretic and expectorant.
Senna.	Senna.	Leaves.	Cathartic.
Sulphur	Sulphuris.	Yellow powder.	Alterative and laxative.
Salt (common).	Sodæ chloridi.	White powder.	Antiseptic, purgative, emetic.
Sandal-wood.	Santalum.	Oil of the wood.	Astringent and diuretic.
Sweet spirits of nitre.	Spiritus æth nitrosi.	Colorless liquid.	Diaphoretic and diuretic.
Spirits of mindererus.	Liq. ammoniæ acetatis.	“ “	“ “
Sweet flag.	Calamus.	Rhizome.	Stimulant and tonic.
Sugar (white).	Sacchari albæ.	White powder.	
Sugar of lead.	Plumbi acetatis.	White lumps.	Astringent, sedative, externally.
Skunk cabbage	Dracontium.	Root.	Antispasmodic, narcotic, and stimulant.
Saffron.	Crocus.	Dried stigma.	Antispasmodic, and stimulant to the skin.
Scammony.	Scammonium.	Root and resin.	Drastic cathartic.
Sage.	Salvia.	Leaves.	Aromatic, astringent, and tonic.
Sherry wine.	Vini Xerici.	Amber-colored liquid.	Stimulant.
Tannic acid.	Acidi tannici.	Yellowish powder.	Astringent and hæmastatic.
Thorn apple.	Strammonium.	Leaves and seeds.	Deliriant and narcotic.
Tar.	Picis liquidæ.	Thick brown liquid.	Used externally in skin diseases.
Tartar emetic.	Antimonii et potassii tartratis.	White powder.	Emetic, alterative, and antiphlogistic.
Tobacco.	Tobacum.	Leaves.	Diuretic, emetic, narcotic, and sedative.
Turpentine.	Terebinthina.	Colorless liquid.	Astringent, hæmastatic, anthelmintic, etc.
Tansy.	Tanacetum.	Whole herb.	Anthelmintic and antispasmodic.
Verdigris.	Cupri subacetatis.	Pale-green mass.	Anticonvulsive, astringent, tonic.
White oak.	Quercus alba.	Bark.	Astringent.
Wild cherry.	Prunus Virginiana.	“	Sedative and tonic
Willow.	Salix.	“	Antiperiodic, astringent, tonic.
White vitriol.	Zinci sulphatis.	White crystals.	Astringent, caustic, and emetic.
Whiskey.	Spiritus frumenti.	Brown liquid.	Stimulant.
Wormseed.	Chenopodium.	Fruit.	Althelmintic.
Wormwood.	Absinthium.	Flower tops.	Anthelmintic, stomachic tonic.
Witch-hazel.	Hamamelis Virginica.	Bark.	Astringent and sedative
Wintergreen.	Gaultheria.	Leaves.	Astringent, tonic, antirheumatic.
Yellow jasmine.	Gelsemium.	Root.	Febrifuge, nervous, and arterial sedative.

TABLES.

Table of Doses of Medicines in Common Use.

Opium and its compounds should not be given to infants or the aged. The dose is graded by age, as follows: —

For adults, from 20 to 60 years, full dose.
Under 20 years, ⅔ of the adult dose.
" 14 " ½ " " " "
" 7 " ⅓ " " " "
" 4 " ¼ " " " "
" 3 " ⅙ " " " "
" 2 " ⅛ " " " "
" 1 " 1/12 to 1/16 of the adult dose.

Table of Apothecaries' Weights.

1 pound = 12 ounces;
1 ounce = 8 drachms;
1 drachm = 3 scruples
1 scruple = 20 grains.

Measures of Capacity.

1 gallon = 8 pints;
1 pint = 16 fluid ounces;
1 ounce (fluid) = 8 fluid drachms;
1 drachm = 60 minims;
1 drop = about ½ minim.

DOSES.

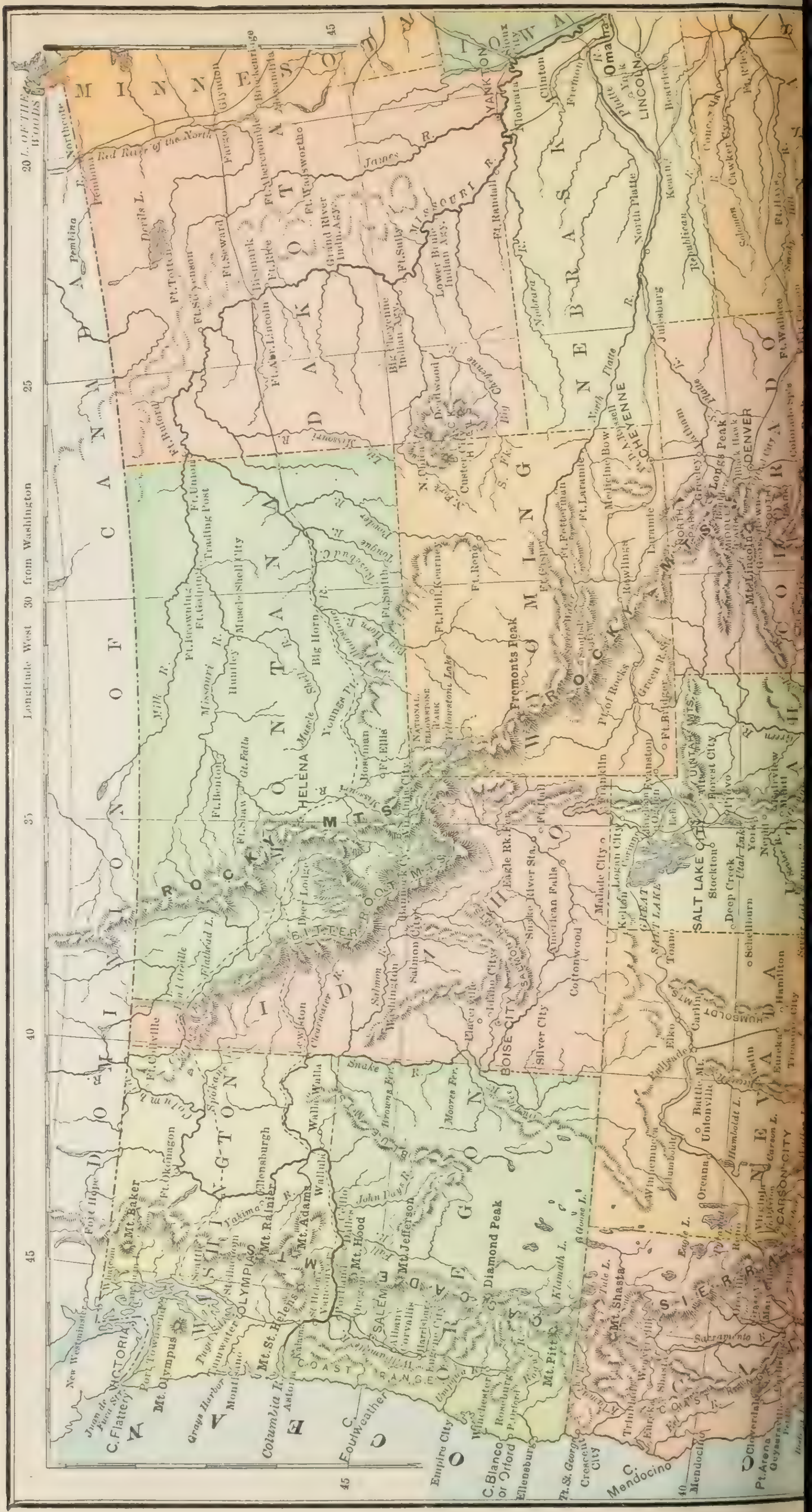
The following are doses for adults: —

Alum, as an astringent, 15 grains; as an emetic, ½ a teaspoonful with ipecac powder.
Antimony wine, as an emetic, tablespoooonful; in fevers, 5 drops.
Barley-water, at pleasure.
Black draught, 2 tablespoonfuls or more.
Brimstone and treacle, equal parts, a teaspoonful.
Bromide of potassium, 15 to 30 grains.
Cajeput oil, 3 drops.
Calomel as a purgative, 3 to 5 grains.
Camphor water, 2 tablespoonfuls or more.
Camphor spirits, 10 to 30 drops.
Carbonate of magnesia, 30 grains
Carbonate of potash, 10 grains.
Carbonate of soda, 15 grains.
Castor oil, teaspoonful to 2 tablespoonfuls
Chalk mixture, 2 tablespoonfuls.
Chamomile tea, wineglassful.
Charcoal, teaspoonful.
Chloral, 10 to 15 grains.
Chloric ether, 15 drops.
Chlorodyne, 10 drops.
Cod-liver oil, teaspoonful to tablespoonful.
Colchicum wine, 15 drops.
Confection of senna, teaspoonful.
Confection of sulphur, teaspoonful.
Decoction of aloes, 2 tablespoonfuls.
Decoction of bark, 2 tablespoonfuls.
Decoction of broom tops, 2 tablespoonfuls or more.
Decoction of dandelion, 2 tablespoonfuls or more.
Decoction of sarsaparilla, 2 tablespoonfuls.
Dover's powder, 10 grains.
Dill water for children, teaspoonful.
Epsom salts, teaspoonful to half an ounce.
Ergot, liquid extract, 15 drops.
Essence of anise, 15 drops.
Essence of camphor, 10 drops.
Essence of ginger, 15 drops.
Essence of peppermint, 15 drops.
Friar's balsam, half a teaspoonful.
Gallic acid, 10 grains.
Gregory's powder for children, 10 grains.
Grey powder, 5 grains.
Infusion of columbo, 2 teaspoonfuls or more.
Infusion of cascarilla, 2 tablespoonfuls or more.
Infusion of gentian (compound), 2 tablespoonfuls or more.
Infusion of quassia, 2 tablespoonfuls or more
Infusion of orange-peel, 2 tablespoonfuls or more.
Iodide of potash, 5 to 10 grains.
Ipecac wine, as an emetic, a tablespoonful.
Laudanum, 10 to 20 drops; for cough, 10 drops.
Lavender compound tincture, teaspoonful.
Lime water, 2 tablespoonfuls or more.
Liquorice powder compound, ½ to 1 teaspoonful.
Mustard as an emetic, tablespoonful in warm water.
Paregoric elixir, ½ teasponful to tablespoonful.
Peppermint-water, 2 tablespoonfuls.
Pepsin, 3 to 5 grains.
Sal volatile, 10 to 30 drops in water.
Sarsaparilla decoction, 2 tablespoonfuls or more.
Senna tea, a cupful.
Spirits of camphor, 10 to 30 drops.
Spirits of chloroform, 15 drops.
Spirits of horse-radish, 30 drops.
Spirits of juniper, teaspoonful.
Steel wine for children, teaspoonful.
Sweet spirits of nitre, ½ a teaspoonful to a teaspoonful.
Syrup of popies, for children, ½ a teaspoonful.
Syrup of senna, for children, teaspoonful.
Syrup of sarsaparilla compound, tablespoonful.
Syrup of rhatany, tablespoonful; for a child, ½ a teaspoonful.
Syrup of lettuce, 2 to 3 teaspoonfuls.
Syrup of rhubarb, for children, teaspoonful.
Syrup of blackberry-root, 1 to 2 teaspoonfuls.
Syrup of squills, 1 teaspoonful, for cough.
Tannic acid, 10 grains.
Tar water, 2 tablespoonfuls or more.
Tincture of bark, teaspoonful.
Tincture columbo, teaspoonful.
Tincture ginger, 20 drops.
Tincture nux vomica, 10 drops.
Tincture steel, 10 to 15 drops.
Tincture rhubarb, teaspoonful to 2 tablespoonfuls.

POISONS AND THEIR TREATMENT.

POISON.	SYMPTOMS.	TREATMENT.
Acetic acid; carbolic acid; muriatic acid; aquafortis; spirits of salt; nitric acid; sulphuric acid; oil of vitriol,	Great heat and burning pain in the stomach and intestines; burning pain in throat; tongue swollen; vomiting matters often bloody; great thirst; convulsions, ending in death,	Alkalies; baking-soda; saleratus; magnesia; plaster scraped from the walls; lime-water; soapsuds; whiting; flaxseed tea; mucilages; chalk.
Oxalic acid; salt of lemons; acid of sugar; tartaric acid; salt of grapes,	Burning heat of stomach; vomiting sometimes; great prostration; spasmodic respirations; convulsions,	Magnesia; whiting; chalk; Epsom salts; plaster; lime. If no vomiting, tickle the throat with a feather.
Prussic acid; hydrocyanic acid; oil of bitter almonds,	In large doses, immediate death; in smaller, nausea, faintness, pain in head, vertigo, loss of sight, difficult respiration,	Strike on back; apply ammonia or smelling-salts to nose; artificial respiration; chloride of lime to nose; cold water dashed over body and head; mustard plaster over stomach and heart. Iron, obtained by adding ammonia to tincture of iron, is the chemical antidote.
Lye; pearl ashes; smelling salts; hartshorn; ammonia; nitre; sal volatile,	Excoriations of mouth and throat; burning pain in stomach. In some cases vomiting; in others, colicky pains,	Lemon-juice; vinegar and water; oils; fats; butter; flaxseed tea. When ammonia has been inhaled, inhale vapor of vinegar.
Arsenic; fly-powder; king's yellow; Paris green,	Metallic taste in mouth; great flow of saliva; nausea and vomiting; heat in stomach, and griping; cold sweats; labored respiration; delirium; convulsions,	Give warm water; tickle throat to produce vomiting; light magnesia; eggs; oils and fats; animal charcoal; abundant draughts of sweet milk; starch; lime-water.
Tartar-emetic, and antimony salts,	Severe vomiting and hiccough; heartburn; stomach pains; colic and purging; cold skin,	Strong coffee and tea; stimulants; warm, oily liquids; astringents; tannin, etc.
Lunar caustic; hair-dyes; indellible ink,	Great pain and burning in stomach,	Give common salt in warm water.
Strychnia; nux vomica,	Convulsions; body bent backwards or forwards; lock-jaw; clenched hands; ghastly grin,	Produce vomiting; tea; coffee; stimulants; charcoal.
Belladonna; deadly nightshade; atropia; hyocyamus; henbane; stramonium; thorn-apple,	Dryness and redness of throat and tongue; dilated pupil; impaired vision; thirst; flushed face; hurried breathing; delirium; convulsions; deep sleep,	Emetic of warm water; salt, or mustard; castor oil; brandy and water; laudanum, fifteen drops every two hours; three drops for a child.
Aconite; monkshood; wolfsbane; digitalis; foxglove,	Slow or weak pulse; much excitement, and confusion of intellect; cold, clammy skin; gastric pain. The first three produce a tingling sensation of tongue and lips,	Produce vomiting with warm water, salt, or mustard; tickle back of throat; charcoal; stimulants; hot bottles to feet; friction over the body. Keep patient on back; give tea, coffee, laudanum, same doses as above.

Poison.	Symptoms.	Treatment.
Alcohol,	Large quantities produce confusion of intellect, followed by deep sleep with snoring,	An emetic of common salt and warm water; aromatic spirits of ammonia; strong coffee; cold water dashed over body.
Bluestone; verdigris; copper sulphate,	Violent headache; vomiting; pain in bowels; cramps of lower limbs; diarrhœa; convulsions,	Promote vomiting with warm water; give coffee, tea, milk, and stimulants.
Salts of zinc; white vitriol; iron salts; copperas,	Pain in abdomen; vomiting and diarrhœa; quick pulse; contraction of features; coldness of extremities,	Tea and coffee; infusions of oak bark; milk; carbonate of sodium.
Opium; laudanum; morphia; soothing syrups; paregoric,	Drowsiness; moist, livid skin; slow respiration; snoring; slow pulse; convulsions, especially in children,	Promote vomiting with warm water, salt, or mustard. Give strong coffee and tea; tannin. Keep patient constantly in motion; keep him awake by sticking pins into him; cold water dashed over body and face, etc.
Salts of mercury; corrosive sublimate,	Metallic taste in mouth; great flow of saliva; nausea; vomiting and fainting; griping and purging; cold sweats; slow respiration; delirium, and convulsions,	Promote vomiting with warm water; the white of one egg, or flour and water; iron filings; stimulants if needed.
Tobacco,	Trembling and spasms; vomiting and purging; giddiness; delirium; cold sweats; cold, clammy skin,	Promote vomiting; give castor oil; ammonia to nose; mustard plaster over heart; and stimulants.
Sugar-of-lead; lead and its salts,	Constipation; violent colic; retraction of abdomen; hard, small pulse; difficult breathing, etc.,	Emetics of warm water and salt, or mustard; Epsom salts; sal rochelle; dilute sulphuric acid, twenty drops in water.
Poisonous gases; smoke; fire-damp; choke-damp, etc.,	Great drowsiness; difficult respiration; loss of muscular power and sensibility; deep sleep; face and body swollen and livid; eyes prominent,	Remove patient to fresh air; elevate head; dash cold water over face and head; stimulating friction to chest and extremities with mustard; artificial respiration.
Poisonous food,	Vomiting and griping; pain in stomach, etc.	Give emetic of warm water and salt, afterwards a dose of castor oil.
Phosphorus; phosphorous paste; lucifer matches; rat poison,	No effects before three to twelve hours; tongue white; sense of weakness; nausea; vomiting; diarrhœa or constipation; great thirst; hot skin; later, delirium, convulsions, insensibility,	Emetic of blue stone; magnesia; mucilaginous drinks; stimulants, if needed; avoid oils; those working amongst phosphorus should pay particular attention to their teeth, as necrosis, or death of the lower jaw, generally starts from an unsound tooth.
Creosote; carbolic acid; coal oil; kerosene oil,	Mucous membrane of mouth white in patches from the first two; odor of the breath; nausea, vomiting, patient passing rapidly into a stupor, with slow, irregular respiration, cold, clammy skin; weak pulse,	Oils, olive or castor, in large quantities; eggs; milk; flour and water, sacchrate of lime; stimulants, if needed.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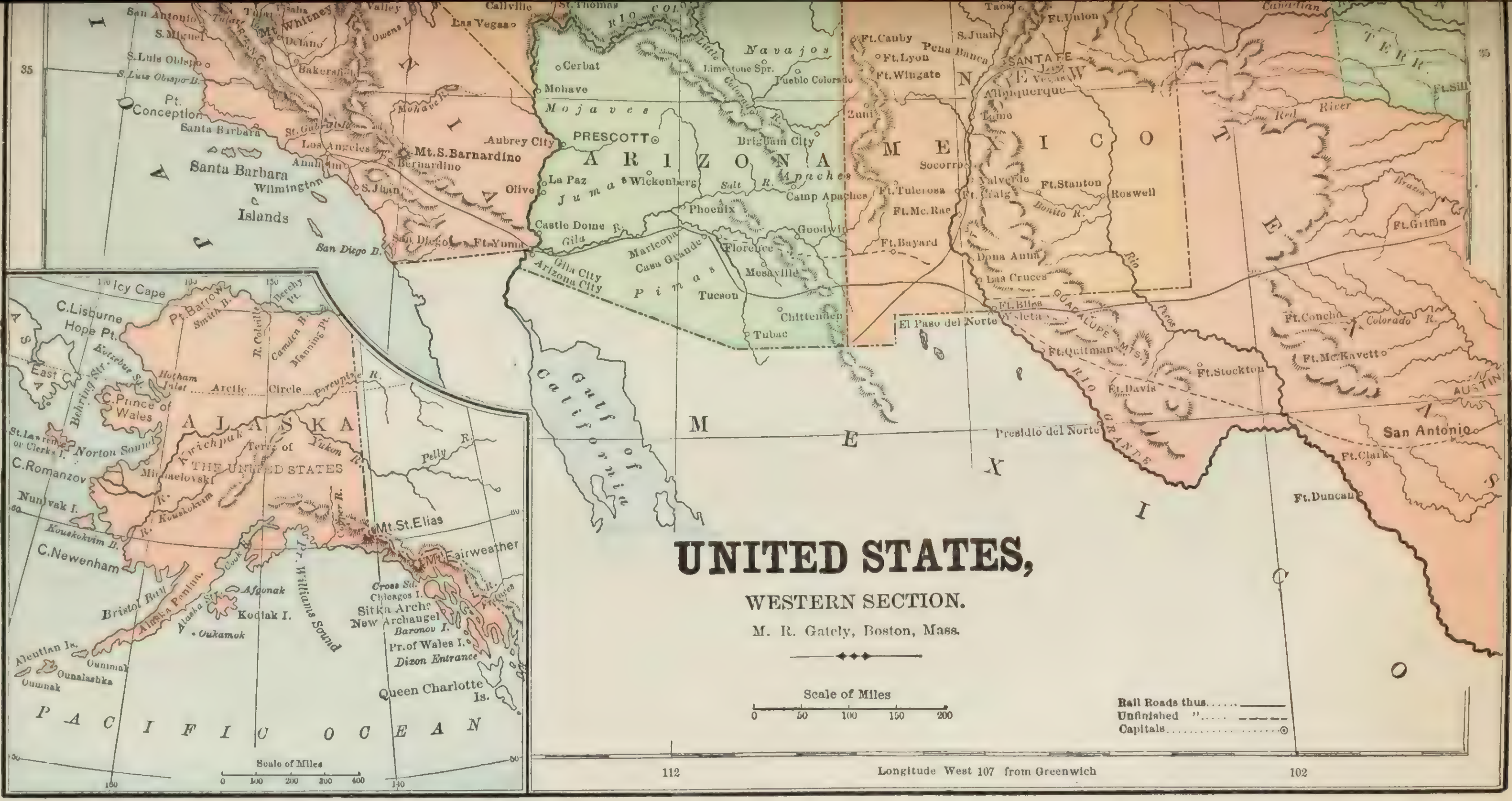
DOMINION OF CANADA
MINNESOTA
DAKOTA
IOWA
NEBRASKA
MONTANA
WYOMING
COLORADO
IDAHO
UTAH
NEVADA
OREGON
WASHINGTON
PACIFIC OCEAN
ROCKY MTS.
BITTER ROOT MTS.
COAST RANGE
SIERRA
HUMBOLDT MTS.
UINTAH MTS.
GREAT SALT LAKE
VICTORIA
OLYMPIA
SALEM
BOISE CITY
HELENA
SALT LAKE CITY
CHEYENNE
DENVER
CARSON CITY
LINCOLN
YANKTON
Omaha
Pembina
Red River of the North
Devils L.
Ft. Totten
Ft. Stevenson
Bismark
Ft. Abr. Lincoln
Ft. Buford
Ft. Union
Ft. Benton
Ft. Shaw
Ft. Ellis
Ft. Colville
Walla Walla
Spokane
Lewiston
Mt. Baker
Mt. Olympus
Mt. Rainier
Mt. Adams
Mt. St. Helens
Mt. Hood
Mt. Jefferson
Diamond Peak
Mt. Pitt
Mt. Shasta
Portland
Astoria
Columbia R.
C. Flattery
C. Foulweather
C. Blanco or Orford
C. Mendocino
Pt. St. George
Pt. Arena
Empire City
Crescent City
Fremonts Peak
Longs Peak
Mt. Lincoln
Deadwood
Custer City
Laramie
Ft. Laramie
Ft. Bridger
Evanston
Ogden
Elko
Hamilton
Austin
Eureka
Humboldt L.
Klamath L.
Snake R.
Missouri R.
Yellowstone Lake
NATIONAL YELLOWSTONE PARK
Platte R.
North Platte
Julesburg
Ft. Wallace
Ft. Randall
Sacramento R.



UNITED STATES,

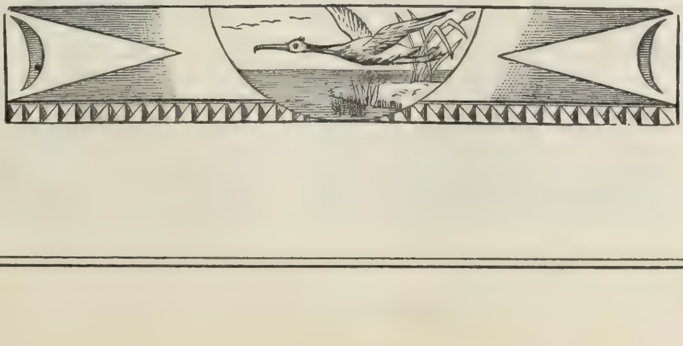
WESTERN SECTION.

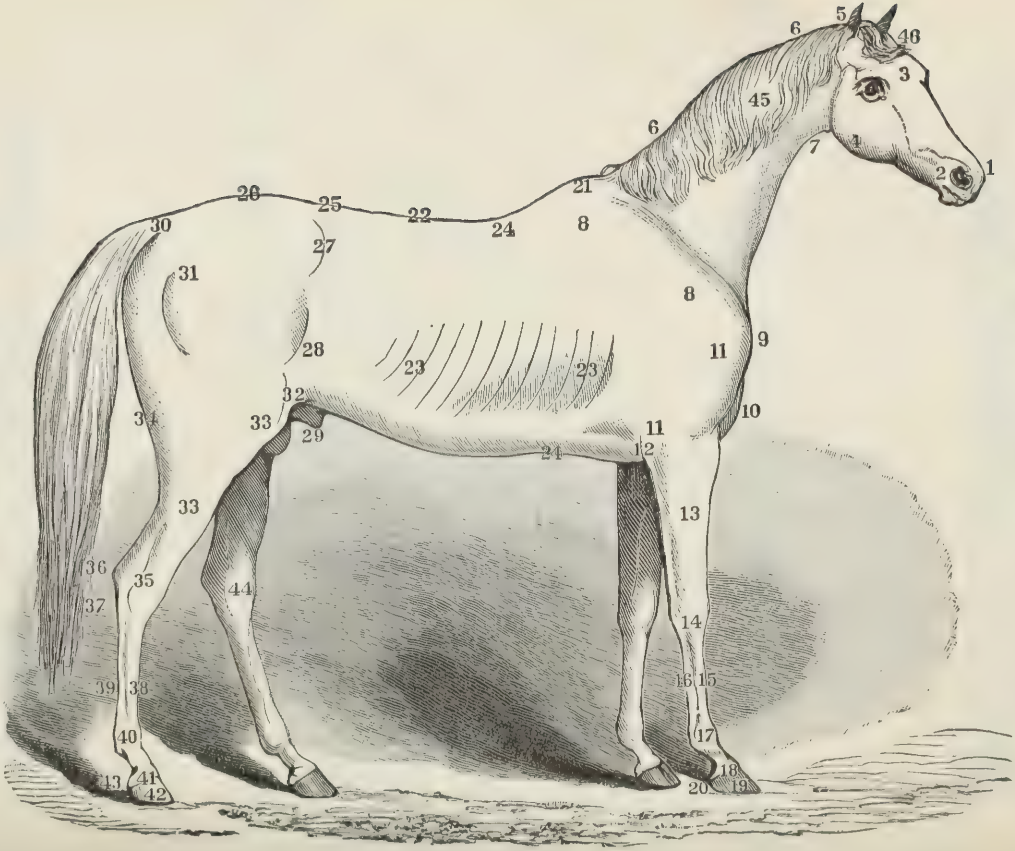
M. R. Gately, Boston, Mass.

GATELY'S UNIVERSAL EDUCATOR.

VOLUME III.

GRAMMAR, ENGLISH POETRY, RHETORIC, LOGIC,
ELOCUTION, PHONOGRAPHY, SYNONYMS,
PRONUNCIATION OF FOREIGN LANGUAGES, PENMANSHIP,
QUOTATIONS FROM FOREIGN LANGUAGES, MUSIC,
LETTER WRITING, BOOK-KEEPING, DEPORTMENT,
HOUSEHOLD, GAMES, TAILORS' MEASURES.





1. **Muzzle.**
2. Nostril.
3. Forehead.
4. Jaw.
5. Poll.
6. Crest.
7. Thropple, or wind pipe.
8. Shoulder blade.
9. Point of shoulder.
10. Bosom or breast.
11. True arm.
12. Elbow.
13. Forearm (arm).
14. Knee.
15. Cannon-bone.
16. Back sinew.
17. Fetlock or pastern joint.
18. Coronet.
19. Hoof, or foot.
20. Heel.
21. Withers.
22. Back.
23, 23. Ribs (forming together the barrel or chest).
24, 24. The circumference of the chest at this point, called the girth.
25. The loins.
26. The croup.
27. The hip.
28. The flank.
29. The sheath.
30. The root of the dock or tail.
31. The hip joint, round or whirl bone.
32. The stifle joint.
33, 33. Lower thigh or gaskin.
34. The buttocks.
35. The hock.
36. The point of the hock.
37. The curb place.
38. The cannon-bone.
39. The back sinew.
40. Pastern or fetlock joint.
41. Coronet.
42. Foot or hoof.
43. Heel.
44. Spavin place.
45. Mane.
46. Forelock.

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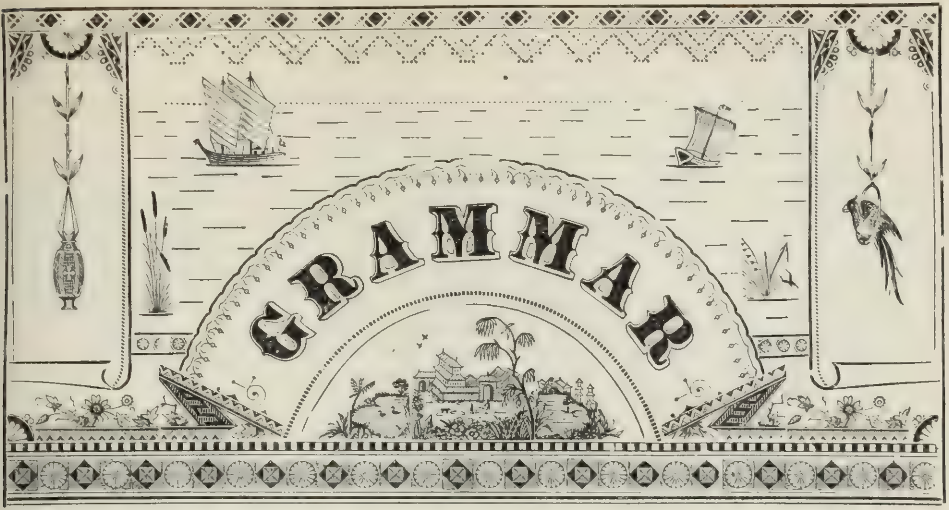

GRAMMAR is the science which treats of the principles of language. **English Grammar** treats of the principles of the English language, and teaches the art of speaking and writing it correctly. It is divided into five parts; viz., Orthography, Orthoepy or Pronunciation, Etymology, Syntax, and Prosody.

Orthography treats of elementary sounds, the letters by which they are represented, and the correct spelling of words.

Etymology treats of the derivation, classification, and properties of words.

Syntax treats of the relation and arrangement of words in sentences.

Prosody treats of punctuation, utterance, figures, and versification.

ORTHOEPY OR PRONUNCIATION.

A *letter* is a character denoting one or more of the elementary sounds of language.

There are in the English language about forty elementary sounds, which are represented by twenty-six letters, called the *alphabet*. The letters are: A a, B b, C c, D d, E e, F f, G g, H h, I i, J j, K k, L l, M m, N n, O o, P p, Q q, R r, S s, T t, U u, V v, W w, X x, Y y, Z z. These are divided into *vowels* and *consonants*.

A **vowel** is a letter which forms a perfect sound when uttered alone. The vowels are *a*, *e*, *i*, *o*, *u*, and sometimes *w* and *y*. When *w* and *y* are followed in the same syllable by a vowel they are consonants, but in other situations they are vowels.

A **diphthong** is a union of two vowels in one syllable; as, C*æ*sar. A *proper* diphthong is one in which both vowels are sounded; as, *oy* in boy; or *ou* in ground. An *improper* diphthong is one in which only one vowel is sounded; as, *ea* in heat; *ou* in your.

A **triphthong** is a union of three vowels in one syllable; as, b*eau*ty, b*uoy*.

A **consonant** is a letter which cannot be distinctly uttered till joined to a vowel. The consonants are *b*, *c*, *d*, *f*, *g*, *h*, *j*, *k*, *l*, *m*, *n*, *p*, *q*, *r*, *s*, *t*, *v*, *x*, *z*, and *w* and *y* in the case heretofore mentioned. These are again divided into *mutes* and *semivowels*.

The **mutes** cannot be sounded at all without the aid of a vowel. They are *b*, *p*, *d*, *k*, *q*, *t*, and *c* and *g* hard; as in *sac*, *gag*.

The **semivowels** are so called because they cannot be distinctly uttered alone, being in nature between a vowel and a mute. They are *l*, *m*, *n*, *r*, *s*, *z*.

Of the semivowels, *l*, *m*, *n*, and *r* are called *liquids*, because they seem to flow into the sound of other letters; *s* and *z* are called sibilants on account of their hissing sound.

A **silent** letter is one not sounded; as, *w* in wrong; *h* in hour.

A **final** letter is one which ends a word.

Some words are uttered with one impulse of the voice; as, *man, boy, through.*

Other words require several impulses of the voice; as, *go-ing, do-ing, pri-ma-ry.*

This gives rise to a division of words into syllables.

A **syllable** consists of one or more letters forming one sound; as, *name, house, man.*

Syllabication is the division of words into syllables, joining to each syllable those letters which the correct pronunciation of the word gives to it. Compound words are divided into their primitives; and other words are usually divided according to their prefixes, suffixes, or grammatical endings, if they have any; as, *not-with-stand-ing, lov-er, nev-er-the-less.* Should, however, the pronunciation conflict with this, the word is divided according to the pronunciation; as, *prop-o-si-tion.* A word of more than one syllable may be divided at the end of a line, but only at the close of a syllable.

A **monosyllable** is a word of one syllable; as, *man, girl, horse.*

A **dissyllable** is a word of two syllables; as, *man-ly, wo-man, hunt-er.*

A **trisyllable** is a word of three syllables; as, *nat-u-ral, man-i-fest.*

A **polysyllable** is a word of more than three syllables; as, *con-sci-en-tious-ness, su-prem-a-cy.*

The **ultimate** is the last syllable of a word.

The **penult** of a word is the second syllable from the end, and the **antepenult** is the third syllable from the end.

ACCENT.

Accent is that peculiar stress of voice which, in pronunciation, distinguishes one syllable of a word from another. Ex. — An in-va-lid′; it is in-val′-id; Au′-gust, a month; au-gust′, stately.

All English words of more than one syllable have an accented syllable, and polysyllables have generally a primary and secondary accent. Ex. — *Im′-prac′-ti-ca-ble.*

Some compound words have two accents about equal in stress. Ex. — *Fare′-well′, man′-kind′.*

The general tendency in English is, in dissyllables, to place the accent on the first syllable; and, in polysyllables, on the antepenultimate.

The words in our language derived from Latin and Greek are, as a rule, accented in accordance with their derivation, though in many cases the English analogy prevails over the foreign.

Words adopted into our language from the Latin without any change of orthography, as a rule, retain the Latin accent, especially if they are terms used in the arts and sciences.

Scriptural, Latin, or Greek names have always the accent on the penult or on the antepenult. Ex. — *Je-ru′-sa-lem, Eu-rip′-i-des, Cor-i-o-la′-nus.*

Some words of seven or eight syllables have one primary and two secondary accents. Ex. — *In-com′-pre-hen′-si-bil′-i-ty.*

Many words of three or more syllables have a secondary accent nearly as strong as the primary. Ex. — *Rep′-ri-mand′.*

Some words of three syllables are accented on the first syllable when nouns, and on the last when verbs. — Ex. — *O′-ver-flow, o-ver-flow′.*

Words ending in *sion* and *tion* have the accent on the penultimate syllable. Ex. — *Medita′tion.*

Words ending in *ia, ial, iac, ian, eous,* and *ious* have the accent on the preceding syllable.

When the vowels *e* and *i* in these terminations are preceded by *c, g, s, t,* or *x,* these vowels are generally pronounced with those that follow in one syllable. Ex. — *Anx′ious, conta′gious.*

The only exception to this rule, in regard to placing the accent, is the word *elegiac,* which is generally pronounced *elegi′ac,* though some pronounce it *ele′giac.*

Words ending in *tive* have the accent on the penult when preceded by a consonant. Ex. — *Consump′tive, presump′tive.*

Words ending in *eal,* of three or more syllables, are accented on the antepenult. Ex. — *Fune′real, corpo′real.*

The only exception to this rule is *hymene′al,* which is accented on the penult.

There is a class of words ending in *or,* which, when used with their correlatives in law language, have the accent on the last syllable. Ex. — *Grantor′, grantee′; legator′, legatee′.*

Some of these words, when not used in such connection, are not accented on the last syllable. Ex.— *Do'nor, devi'sor.*

Good authority may be found for the pronunciation of some words in different ways. Ex.— *Con'fessor* or *confess'or, adver'tisement* or *advertise'ment.*

The pronunciation of the following words, when used as verbs, is different from what it is when used as nouns or adjectives, *s* having in the latter case its hissing sound, and in the former case the sound of *z*, indicated by the *cedilla;* thus:—

Nouns and Adjectives.	Verb.	Nouns and Adjectives.	Verb.
Close	Cloşe	Diffuse	Diffuşe
Grease	Greaşe	Excuse	Excuşe
House	Houşe	Mouse	Mouşe
Rise	Rişe	Use	Uşe.

ORTHOGRAPHY.

Letters are used in various styles; as,—

Roman, *Italic*, Old English, ORNAMENTAL, **Clarendon**, **Full-face**.

They are also printed in types of different sizes; as,—

Great Primer, English, Pica, Small Pica, Long Primer, Bourgeois, Brevier, Minion, Nonpareil, Agate, Pearl, Diamond.

CAPITAL LETTERS.

Capital letters should not be used indiscriminately, or without good reason, when the sense can be as well, or perhaps better, expressed by smaller letters.

The following rules are laid down for their use. A capital letter should begin,—

1. The first word of every sentence.
2. The first word of every line of poetry, unless it be a broken part of the preceding line.
3. The first word of a formal or direct quotation.
4. All proper nouns, and adjectives derived from them.
5. Common names personified.
6. The names of the days of the week, and of the months of the year, but generally not of the easons.
7. The titles of books, and heads of their principal divisions.
8. The pronoun *I* and the interjection *O*.
9. Names of the Supreme Being.
10. Abbreviations formed by single letters should be capitals.

SPELLING.

Spelling is the art of expressing words by their proper letters in regular order. Very few rules for pelling can be given to which the exceptions are not so numerous as to render the rule of comparatively ttle value; but the following are a few of the more general:—

I. Monosyllables ending in *f*, *l*, or *s*, preceded by a single vowel, double the final consonant; as, *uff, lass.*

II. When the vowel precedes any other consonant than *f*, *l*, or *s*, that consonant remains single. xceptions: *ebb, add, odd, egg, inn, butt, purr, buzz.*

III. An added termination does not change the orthography of the primitive word. There are me exceptions, however; as, *well, welfare; pass, pastime.*

Primitive words accented on the final syllable and ending in a single consonant, preceded by a single vowel, generally double their final letter before a suffix commencing with a vowel; as, *rob, robber; fun, funny; hot, hottest;* and although *l* final was also frequently doubled by the old writers when its syllable was unaccented; as, *revel, reveller;* it is the custom with later writers to double the final *l* only when its syllable is accented, and it better conforms with analogy. Final *e* of a primitive word is generally omitted before *able, ible, ing,* and *ish.* Exceptions: *singe, singeing; dye, dyeing;* and when *e* follows *c* or *g* soft, as *peace, peaceable; charge, chargeable.*

Primitive words ending in *ll* generally drop one *l* before *full, ly, ness, less,* and also frequently in others; as, *dull, dulness; skill, skilful; always, welfare.*

Final *y* of a primitive word, when preceded by a consonant, becomes *i* before a syllable beginning with a consonant; as, *merry, merrily; cloudy, cloudiness.*

Final *y* undergoes the same change in forming verbal nouns, past participles, the person of verbs, the plural of nouns, and the degrees of adjectives; as, *carry, carries, carried, carrier; merry, merrier, merriest.* Exceptions: verb forms ending in *ing* retain the *y* in order that the *i* may not be doubled; as, *rally, rallying.*

The orthography of other words may be learned by consulting the dictionary; but one of the best ways to become a correct speller is to read carefully the works of the best authors, and observe the formation of the words. When writing, if there is any doubt as to the correct spelling of a word, consult the dictionary, as it is better to do so in regard to every word than to misspell a single one.

ETYMOLOGY.

Words are the sounds, or combination of sounds, which we make use of to express our thoughts.

Words are divided, according to their formation, into *primitive, derivative,* and *compound.*

A *primitive* word is one which is not formed from another word; as, *go, learn.*

A *derivative* word is one which is formed from some other word, generally by the addition of *prefixes* or *suffixes,* or both; as, *go-ing, learn-ed, un-learn-ed.*

A *prefix* is a letter or letters joined to the beginning of a word to modify its meaning; as, *un,* in *un-able.*

The following are some of the most common **prefixes**, with their significations: —

A: *on, in, to;* as, a-shore, on shore; a-field, to the field.

A, ab, abs: *from;* as, a-vert, to turn *from;* ab-solve, to release *from.*

Ad, a, ac, af, al, an: *to;* as, ad-here, to stick *to;* annex, to tie *to.*

A, an: *without;* as, a-pathy, *without* feeling.

Am: *around;* as, am-putate, to cut *around.*

Amphi: *about, on both sides, double;* as, amphi-theatre, a theatre with seats *on both sides,* or *circular.*

Ante: *before;* as, ante-date, to date *before;* ante-meridian, *before* noon.

Anti: *against;* as, anti-pathy, a feeling *against.*

Bene: *well;* as, bene-volent, wishing *well.*

Bi, bis: *twice* or *two;* as, bi-sect, to cut in *two;* bis-cuit, baked *twice.*

Circum, circu: *around;* as, circum-navigate, to sail *around;* circu-itous, going *around.*

Cis: *on this side;* as, cis-alpine, *on this side* of the Alps.

Con, co, cog, col, com, cor: *with or together;* as, condole, to grieve *with or together;* compose, to put *together.*

Contra, contro, counter: *against;* as, contra-dict, to speak *against;* contro-vert, to turn *against;* counter-act, to act *against.*

De: *down* or *from;* as, de-scend, to climb *down;* de-spise, to look *from.*

Dis, di, dif: *apart, away, asunder;* as, dis-perse, to scatter *apart;* dif-fer, to bear *apart.*

E, ex, ec, ef: *out, out of, from;* as, e-ject, to throw *out;* ex-member, an *out* member.

Epi: *upon;* as, epi demic, *upon* the people.

Extra: *beyond;* as, extra-ordinary, *beyond* ordinary.

Hemi: *half;* as, hemi-sphere, *half* a sphere.

In, im, il, ir: *not;* as, in-elastic, *not* elastic; im-modest, *not* modest.

Inter: *between;* as, inter-vene, to come *between.*

Intro: *within;* as, intro-duce, to lead *into* or *within.*

Meta: *beyond;* as, meta-phor, a carrying *beyond* the proper meaning.

Non: *not;* as, non-sense, *not* sense.

Out: *beyond;* as, out-live, to live *beyond.*

Para, par: *beside;* as, para-dox, a writing *beside,* or *by the side of* the main question.

Per: *through;* as, per-cent, *through or by the* hundred.

Post: *after;* as, post-cript, a writing *after* the letter.

Pre: *before;* as, pre-engage, to engage *before.*

Preter: *beyond;* as, preter-natural, *beyond* natural.

Pro: *forth, forward;* as, pro-pose, to put *forth, pro-pel.*

Re: *back or again;* as, re-enter, to enter *again.*

Retro: *backwards;* as, retro-spect, a looking *backwards* or on the *past.*

Se: *aside;* as, se-clude, to shut *aside.*

Semi: *half;* as, semi-circle, *half* a circle.

Sub, suc, suf, sug, sup, sur: *under* or *after;* as, sub-scribe, a writing *under;* suc-ceed, to follow *after.*

Super: *above;* as, super-natural, *above* nature; super-cargo, *over* the cargo.

Syn: *with* or *together;* as, syn-thesis, a placing *together.*

Trans, tra: *beyond, through, over;* as, trans-atlantic, beyond the Atlantic,

Un, *not;* as, un-wise, *not* wise.

Ultra: *beyond;* as, ultra-montane, *beyond* the mountain.

SUFFIXES.

Able, ible, ble, le: *that may be;* as, read-able, that *may be* read; .poss-ible, that *may be* done.

Ac: *resembling or relating to;* as, demoni-ac, *like* a demon.

Aceous: *having the qualities of;* as, herb-aceous, test-aceous, composed of shells.

Age: *thing, act,* or *state;* as, herb-age, a *collection of* herbs.

Al: as a noun, *the thing, act, or state;* as an adjective, *relating to;* as, nas-al, *pertaining to* the nose.

An: as an adjective, denotes *relating to;* as a noun, denotes *one who;* as, Itali-an, *relating to Italy;* artis-an, *one who* follows a trade.

Ate: as a verb, denotes *to make or become;* as an adjective, denotes having the nature of; and as a noun, denotes the person or instrument; as, facilit-ate, *to make* easy; affection-ate, *having the nature of* affection.

Eer, ier: *one who;* as, engin-eer, *one who* runs an engine.

Ess: *a female;* as, shepherd-ess, a *female* shepherd.

Fy: *to make or become;* as, simpli-fy, *to make* simple.

Ile, ine: *like or relating to;* as, puer-ile, *like* a boy; serpent-ine, *like* a serpent.

Ish: *having the quality of;* as, salt-ish, having the quality of salt.

Ish, as a verb: *to make or become;* as, fam-ish, *to suffer* hunger.

Ize: *to make or become;* as, popular-ize, *to make* popular.

Ist: *the person who acts or practises;* as, flor-ist, *one who cultivates* flowers.

Ity: *the act or state;* as, brev-ity, the *state of being* brief; liber-ty, the *state of being* free.

Ive: as a noun, denotes *the person or instrument;* as, operat-ive, *one who* operates; as an adjective, it denotes the *act or state of;* as, product-ive, *having the power* to produce.

Ix: *a female;* as, consolatr-ix, *a woman* who consoles.

Ment: *the thing, act, or state;* as, content-ment, *the state of being* contented.

Ness: *the thing, act, or state;* as, happi-ness, the *state of being* happy.

Or: *the person or instrument;* as, grant-or, *the person who* grants; don-or, *the person who* gives.

Ous: *full of;* as, joy-ous, *full of* joy; malici-ous, *full of* malice.

Ship: *the thing, act, or state;* as, friend-ship, *the state of being* a friend.

Tude: *the act or state;* as, soli-tude, *the state of being* alone.

Ule, kin, let, ling: *little;* as, glob-ule, *a little* globe; mani-kin, *a little* man; bul-let, *a little* ball.

Ure: *the thing, act, or state;* as, moist-ure, *that which is* moist; pleas-ure, *the act of* pleasing.

Y: as a noun, denotes *the thing, act, or state;* as, honest-y, *the state of being* honest; as an adjective, it denotes having the nature of; as, mudd-y, sleep-y, grass-y.

PARTS OF SPEECH.

The one hundred thousand words which are contained in the English language are divided, according to their use, into nine classes, called *parts of speech.*

The parts of speech are, —

1. Noun,
2. Pronoun,
3. Article,
4. Adjective,
5. Verb,
6. Adverb,
7. Preposition,
8. Conjunction,
9. Interjection.

The mode of denoting some property belonging to a part of speech is called *grammatical form.*

Grammatical form is denoted either by *inflection,* by *radical change,* by an *auxiliary term,* or by *grammatical relation.*

Inflection is a change in the ending of a word, as, in *reached, ed* is an inflection to denote the grammatical form, *tense.*

Radical change is a change in the vowel of the root word ; as, *man, men.* Here *a* is changed to *e* to denote the gramatical form, *number;* so *throw* is changed to *threw* to denote the past tense.

An auxiliary term is an additional word joined to the word to be modified in meaning.

Grammatical relation is the special use of a word in a sentence; thus, in the sentence, *Summer* will soon be here, "summer" is in what is called the *nominative case,* because it is the subject of the verb "will be"; but, in the sentence, The flowers will bloom in *summer,* "summer" is the object of the preposition "*in,*" and therefore is in the *objective case.*

The words *grammatical form,* as above used, cover all the peculiarities in the English mode of denoting the grammatical properties of words.

Five only of the parts of speech have grammatical form; namely, the noun, the pronoun, the verb, the adjective, and the adverb.

NOUNS.

The word *noun* is derived from the French *nom,* Latin *nomen,* meaning a name; and it is the name of any object, person, or thing which exists, or is conceived of by the mind; as, *John, book, wisdom, purity, study.*

Substantive. — Any word, or any combination of words, which performs the office of a noun is called a *substantive.*

Classes of nouns. — There are two principal classes into which nouns are divided; namely, proper and common.

A *proper noun* is a name which applies to a special or *individual* object; as, *Herbert, Boston, Vermont.*

A *common noun* is a name which applies to each individual of a class of objects, as, *boy, horse, dog.*

Under common nouns are included *collective* nouns, *abstract* nouns, and *verbal* nouns.

A **collective noun** is a name which denotes a collection of individuals regarded as forming one whole; as, *jury, senate.*

An **abstract noun** is the name of some quality or action ; as, *darkness, wisdom, goodness.*

A **verbal noun** is an infinitive or participle employed as a noun, and belongs to the class of abstract nouns; as, *to sing* is difficult; *reading* is profitable.

Properties of nouns. — To nouns belong four grammatical forms; viz., person, number, gender, and case.

Person. — The word *person* was derived by the early grammarians from the language of the stage, in which the three actors required in a play were called the "persons" of the drama ; and "person" in nouns is that property or grammatical form which shows whether the reference is to the speaker, the person or persons spoken to, or the person or thing spoken of. There are three persons, — the first, the second, and the third.

The *first person* denotes the speaker; as, "*I, Cæsar,* command you."

The *second person* denotes the person or persons spoken to; as, "*Thou, God,* seest me."

The *third person* denotes the person or thing spoken of; as, the *house* is on the hill.

NUMBER.

Number is the grammatical form which shows whether one object is referred to, or more than one. There are two numbers, —*singular* and *plural.*

The *singular* number denotes but one ; as, *rock, horse.* The *plural* number denotes more than one ; as, *rocks, horses, dogs.*

The plural of nouns is regularly formed by the addition of *s* or *es* to the singular; as, *book, books; church, churches.*

When the noun ends in *s, x, z, sh,* soft *ch,* or in *i. o, u, y,* preceded by a consonant, *es* is added.

In forming the plural of nouns ending in *y,* preceded by a consonant, change the *y* to *i,* before adding *es;* as, *tory, tories.*

There are a few old English nouns ending in *f* or *fe* which change the *f* or *fe* to *v* before *es.* They are,—

Beef	Beeves.	Knife	Knives.	Self	Selves.	Wife	Wives.
Calf	Calves.	Leaf	Leaves.	Sheaf	Sheaves.	Wolf	Wolves.
Elf	Elves.	Life	Lives.	Shelf	Shelves.	Wharf, wharves or wharfs.	
Half	Halves.	Loaf	Loaves.	Thief	Thieves.	Staff	Staves (sticks). Staffs (officers).

A few words form their plural by radical change. They are,—

Foot	Feet.	Goose	Geese.	Louse	Lice.	Man	Men.
Mouse	Mice.	Tooth	Teeth.	Woman	Women.	I	We.
Thou	Ye.	He, She, It	They.	This	These.	That	Those.

Some nouns are found in the plural form only. The following are the principal words of this class:—

Aborigines.
Annals.
Antipodes.
Archives.
Ashes.
Assets.
Billiards.
Bitters.
Breeches.
Cattle.
Clothes.
Dregs.
Eaves.
Embers.
Entrails.
Goggles.
Headquarters.
Hose.
Hysterics.
Ides.
Lungs.
Nuptials.
Nippers.
Paraphernalia.
Pinchers.
Regalia.
Riches.
Remains.
Scissors.
Shears.
Snuffers.
Stairs.
Statistics.
Stilts.
Suds.
Thanks.
Tongs.
Tidings.
Trowsers.
Tweezers.
Victuals.
Vitals.

Again, a few nouns have the same form for both singular and plural; as, *alms, physics, sheep, deer, wages,* etc. The number of the noun is here to be inferred from the remainder of the sentence; as, a deer was seen by the hunter; deer were seen by the hunter.

Some nouns have two plural forms with different significations; as, *cloth,* cloths (kinds of cloth), clothes (garments); *index,* indexes (contents), indices (algebraic signs).

A few nouns, from the Latin and Greek, retain plurals formed according to the idiom of the languages from which they are derived ; as, *radius, radii; datum, data ; axis, axes; phenomenon, phenonomena.*

A few nouns, from the Italian and Hebrew, follow the same rule; as, *bandit, banditti; cherub, cherubim; seraph, seraphim.*

The plural of compound nouns is generally formed by adding the suffix to the principal noun; as, *fathers-in law.* There are, however, exceptions.

GENDER.

Gender is that grammatical form which denotes the sex of the object named by the noun. There are three genders ; viz., masculine, feminine, and neuter.

The *masculine* gender denotes a male; as, *man, boy.*

The *feminine* gender denotes a female; as, *woman, girl.*

The *neuter* gender denotes neither male nor female; as, *rock, house.*

To these some grammarians add a fourth, called *common* gender, which is employed to denote that the object or objects named may be of either or both sexes ; as, *birds, people, congregations.*

There are three methods of distinguishing gender: —

I. By different words; as, *husband, wife; boy, girl; master, mistress; son, daughter.*

II. By different suffixes; as, *duke, duchess: hero, heroine; sultan, sultana,* or *sultaness.*

III. By using a word denoting sex joined to the noun of undetermined gender; as, *man-servant; maid-servant.*

CASE.

Case is that grammatical form of nouns which denotes how they are used in the construction of sentences. There are three cases in the English language, though nouns have only two case forms.

The cases are the *nominative*, the *possessive*, and the *objective*.

The *nominative* case is that form of the noun employed when it is used as the subject of a finite verb; as, birds fly; or when it is used independently; as, alas, poor man! or absolutely; as, the wind being favorable, we set sail.

A noun is said to be used independently or absolutely when it has no grammatical relation to the remainder of the sentence.

The *possessive* case is that form of the noun used when it denotes possession or ownership; as, the *boy's* pony; the *girl's* slate.

In singulars, and in those plurals which do not end in *s*, the possessive case is regularly formed by adding the letter *s*, preceded by an apostrophe, to the nominative case; but in plurals ending in *s*, the possessive case is regularly formed by adding an apostrophe only to the *s*; as, the *man's* chair; the *boys'* hats.

The *objective* case is the form of a noun when used as the object of a transitive verb or preposition; as, the boy struck the *dog;* the bird is upon the *tree.*

The form of the nominative and objective cases being the same, the case must be determined by the relation of the noun to the verb, or the remainder of the sentence.

DECLENSION.

To decline a noun is to name its three cases in each number; as, —

	Singular.		*Plural.*		*Singular.*		*Plural.*
Nom.	Man	*Nom.*	Men	*Nom.*	Boy	*Nom.*	Boys
Poss.	Man's	*Poss.*	Men's	*Poss.*	Boy's	*Poss.*	Boys'
Obj.	Man;	*Obj.*	Men.	*Obj.*	Boy;	*Obj.*	Boys.

PRONOUNS.

The word *pronoun* is from the Latin words *pro* and *nomen*, literally meaning *for a name;* and a pronoun is a word used instead of a noun; as, *he* runs; *what* did John get?

Pronouns are divided into three classes; viz., *personal, relative,* and *interrogative.*

Personal Pronouns. — A personal pronoun is one which shows by its form of what grammatical person it is. The principal personal pronouns are, *I, you or thou, he, she, it,* and their plurals, *we, you* or *ye*, and *they.*

A personal pronoun is of the *first* person when denoting the speaker; as, *I, we;* of the *second* person when denoting the person addressed; as, *you, thou;* and of the *third* person when denoting the person or thing spoken of; as, *he, she, it.*

All the personal pronouns express *number* and *case;* and the personal pronoun of the third person singular expresses gender.

The personal pronouns are declined as follows: —

1st *Person.*	*Singular.*		*Plural.*	2d *Person.*	*Singular.*		*Plural.*
Nom.	I	*Nom.*	We	*Nom.*	You	*Nom.*	You
Poss.	My or mine	*Poss.*	Our or ours	*Poss.*	Your or yours	*Poss.*	Your or yours.
Obj.	Me;	*Obj.*	Us.	*Obj.*	You;	*Obj.*	You.

3d *Person.*	*Singular.*		*Plural.*
Nom.	He, she, it	*Nom.*	They
Poss.	His, her, its	*Poss.*	Their or theirs
Obj.	Him, her, it;	*Obj.*	Them.

The ancient forms *thou, thine, thee, thyself,* and *ye* are now very little used, and are found only in sacred or poetical works. The possessive forms *ours, yours, hers, theirs,* and generally *mine* and *thine,* are equivalent to *our, your,* etc., with the name of the object possessed; as, he went to his home; I went to *mine* (my home).

Compound personal pronouns are formed only in the nominative and objective cases by the addition of *self* or *selves* to the possessive of the first and second persons, and the objective of the third person; as, *myself, thyself, yourself, himself, herself,* and *itself;* and their plurals, *ourselves, yourselves, themselves.*

Often these compounds are used for emphasis only; as, I *myself* was there.

When used after transitive verbs, they are called *reflexives;* as, he struck *himself.*

Relative pronouns.—A relative pronoun is one which both represents a preceding word called the antecedent, and connects it with a depending proposition; as, one man admires what displeases another; I dare do all that may become a man.

The *antecedent* of a relative pronoun is the noun or pronoun for which it stands; as, the *man* whom I met, etc., in which *man* is the antecedent of the pronoun *whom.*

The relative pronouns are *who, which, what,* and *that,* with their compounds.

Who is employed to represent persons, and objects when regarded as persons; as, the *man* who was sick is dead; and *Avarice,* who sold himself to Hell.

Which is employed to represent things and inferior animals; as, the house *which* we looked at has since been sold; the dog *which* I gave, etc.

What is used in place of the *thing which,* or *things which,* and has no antecedent; as, I found *what* (*the things which*) you wished.

That is employed to represent both persons and things, and is sometimes used instead of *who* or *which.*

That and *what* are indeclinable.

Who and *which* are declined alike in the singular and plural numbers; thus:—

Singular and Plural.—Nom., who; Poss., whose; Obj., whom.

Singular and Plural.—Nom., which; Poss., whose; Obj., which.

Compound relative pronouns are also in use, formed by adding *ever* and *soever* to *who, which,* and *what;* as, *whosoever, whichsoever,* etc. These compounds are called *indefinite* relative pronouns. *Whosoever* is declined thus:—

Nom., whosoever; Poss., whosesoever; Obj., whomsoever.

Interrogative pronouns are those used in asking questions. They are *who, which,* and *what,* and are declined like the corresponding relatives.

Who is employed in asking questions concerning persons; as, *who* is the man?

Which is employed in asking concerning both persons and things, when in a known class or number; as, *which* shall I bring?

What is used to ask questions in an indefinite manner concerning things; as, *what* was the object? what did you say?

ARTICLES.

An article is a word which limits or restricts the meaning of a noun.

The articles are *a, an,* and *the.*

The is called the *definite* article, while *a* and *an* are *indefinite.* This is because *the* is used to point out a particular one of a class of objects, and *a* or *an* to refer to any one of a class of objects; as, *the* boy, *a* boy; *the* apple, *an* apple.

A and **an** are derived from the same Anglo-Saxon root *ane,* which is the original form for the numeral *one.*

A is used before words beginning with a consonant sound, and *an* before words beginning with a vowel sound; as, *a* man, *an* art.

The sound *u* long, or *eu,* also takes *a;* as, *a* European, *a* unit.

H aspirated sometimes takes *a* and sometimes *an;* as, *a* hero, *an* heroic deed. Usually *an* is used when the accent is on the second syllable; as, *an* historical romance.

ADJECTIVES.

The word "adjective" is derived from the Latin word *adjectivus*, meaning something annexed.

An adjective is a word used to describe, limit, or qualify the meaning of a noun or pronoun ; as, a *sweet* apple, *five* men, *wise* dogs.

Two general classes may be made of adjectives: — I. Descriptive ; II. Definitive.

I. **Descriptive** adjectives are those which describe or denote some quality of the noun; as, a *high* tower, a *black* horse. Under this head come the three minor classes, — *proper, participial,* and *compound.*

A *proper* adjective is one derived from a proper noun ; as, *European, American.*

A *participial* adjective is a participle used as an adjective ; as, a *singing* bird, a *laughing* child.

A *compound* adjective is one formed by the union of two simple words; as, a *money-making* business.

II. A **definitive** adjective is one which limits or modifies the meaning of a noun or pronoun ; as, there were *many* heroes in *that* country.

Definitive adjectives are again divided into two classes; viz., *pronominal* adjectives, and *numeral* adjectives.

Pronominal adjectives are those which are used to represent nouns. The principal ones are *this, that, these, those, former, each, every, either, neither, some, none, any, all, such, one, both, few, last, many, several.* These may also be used as limiting adjectives; as, "*All* the world 's a stage"; we have passed *many* happy days; "This is my *own*, my native land."

The following pronominal adjectives are called *demonstratives: this, that, these, those, former, latter, same, such.*

The following are called *distributives : each, either, neither.*

The following are called *indefinites: all, any, another, few, none, other, some.*

When used with nouns, the interrogative and relative pronouns, *which, what, whichever, whatever,* are placed under the head of definitive adjectives; as, *which* road shall we take ? I know *which* road to take.

Numeral adjectives are those which express number in a definite manner ; as, *ten, first.*

Numeral adjectives are divided into two classes; viz, *cardinal* and *ordinal.* A *cardinal* adjective denotes how many ; as, *five* men, *three* boys. The words, *hundred, thousand, million,* etc., are sometimes nouns, and are often preceded by the articles *a* or *an ;* thus, a *hundred* men. *Ordinal* adjectives denote *in what order ;* as, the *third* day ; the *fourth* man.

The ordinals, with the exception of the first two, are formed from the cardinal numerals. *First* is for *foremost,* and *second* is from the Latin word *secundus,* meaning second in order. To cardinals and ordinals a third class is sometimes added, called *multiplicatives ;* as, *double, fifty-fold.*

COMPARISON OF ADJECTIVES.

In many languages adjectives are inflected to show the different genders, numbers, cases, etc.; but in English they have but one grammatical form, called *comparison,* which is used to denote the degree of quality or quantity. There are three degrees of comparison ; viz., *positive, comparative,* and *superlative.*

The *positive* degree expresses the simple quality without modification ; as, a *lofty* tower.

The *comparative* degree expresses the quality in a *greater* or *less* degree; as, *fast, faster, less fast.*

The *superlative* degree expresses the quality in the greatest or least degree possible; as, the *highest* tower ; the *longest* road ; the *least skilful* mechanic.

Adjectives of one syllable regularly form the *comparative* by adding *er* to the positive, and the *superlative* by adding *est* to the positive ; as, bright, brighter, brightest.

Adjectives of more than one syllable regularly form their comparative and superlative by prefixing the adverbs *more* and *most* to the positive ; as, bashful, *more* bashful, *most* bashful.

There are, however, frequent exceptions to these rules, many adjectives of two syllables forming their comparative and superlative by the use of *er* and *est ;* as, tender, tenderer, tenderest.

Besides these, there are some adjectives whose comparison is irregular. The following is a list of the most common : —

Bad, evil, or ill	worse	worst.
Far	farther	farthest.
Good or well	better	best.
Little	less	least.
Late	later or latter	latest or last.
Much or many	more	most.
Near	nearer	nearest or next.
Nigh	nigher	nighest or next.
Out	utter or outer	utmost, uttermost, or outmost.
Old	older or elder	oldest or eldest.
Up	upper	uppermost.

Many adjectives, from their meaning, are incomparable ; as, *dead, empty, round, infinite,* etc.

VERBS.

A *verb* is a word expressing being, action, or state ; as, *go, come, be,* etc.

Verbs are divided into two classes ; viz., *transitive* and *intransitive.*

A **transitive** verb is one requiring an object to complete its meaning ; as, James *struck* the *horse.*

The object used to complete the meaning of a transitive verb is called its *complement.*

When the transitive verb is followed by the reflexives *myself, yourself,* etc., it is said to be used reflexively ; as, he injured himself.

Sometimes this object is not expressed ; as, he *awakes* (*himself,* understood).

An **intransitive** verb is one expressing being, state, or action, not terminating on an object ; as, we all *sleep ;* birds *fly.*

Some intransitive verbs, as, *be, become, seem, appear,* and the like, require a predicate noun, or adjective to complete their meaning.

A few intransitive verbs take an object akin in meaning to the verb ; as, *to live a life ; to run a race.*

A **defective** verb is one in which some of the principal parts are wanting ; as, *may, might.*

A **redundant** verb is one having more than one form for its past tense and past participle ; as, *thrive, thrived* or *throve, thrived* or *thriven.*

An **impersonal** verb is one by which an action or state is asserted with no particular subject ; as, *it is* cold ; *it rains.*

A **regular** verb is one forming its past tense and past participle by the addition of *ed* to the present ; as, *paint, painted.*

An **irregular** verb is one which does not form its past tense and past participle by adding *ed* to the present ; as, *stand, stood ; tell, told, etc.*

To verbs belong five grammatical forms ; viz., *voice, mood, tense, person,* and *number.*

VOICE.

Voice is that grammatical form of a transitive verb which shows whether the subject is the actor or the receiver of the action. There are two voices ; viz., the *active* and the *passive.*

The active voice represents the subject as the actor ; as, the boy *struck* the dog.

The passive voice represents the subject as the receiver of the action ; as, the dog *was struck* by the boy.

Voice belongs to transitive verbs *only*, yet a few intransitive ones have a passive form ; as, he *is fallen.*

The object of the active verb is generally made the subject of the passive ; as, he threw the *ball ;* the *ball* was thrown by him.

MOOD.

The meaning of the word "mood" or "mode" is *manner*, and it is used to denote the grammatical form of the verb expressing the action or state. There are four moods ; viz., the *indicative*, the *potential*, the *subjunctive*, and the *imperative.*

The **indicative mood** denotes what is real, and expresses —

An actual fact or occurrence; as, it rains; I fell.

An interrogation; as, *was* he killed at Petersburg?

A doubt, inference, or condition assumed as a fact; as, if I *am betrayed*, I am lost.

The **potential mood** expresses, either indicatively or subjunctively, our relations to acts or states, and may denote —

Possibility; as, *it may snow.*

Power; as, I *can see* him.

Inclination; as, I *would see* him.

Permission; as, you *may send.*

Necessity; as, I *must run.*

Obligation; as, I *should go.*

A desire; as, *may* you *succeed.*

An interrogation; as, *must* I *suffer?*

The signs of the potential mood are, *may, can, must, might, could, would,* and *should.*

The **subjunctive mood** denotes what is ideal, and may express —

A future possibility; as, *if I write*, I shall write at once.

A wish or supposition; as, *O had I the power of Cæsar!* But I have not.

A conclusion, result, or conception; as, "If it were done when it is done, then *'t were* well it *were done* quickly."

A denial of the fact is generally implied when the subjunctive refers to present or past time; when future time is referred to, the inference is that the fact is contingent or uncertain. This is apparent, as we cannot do a past act, but may a future one; and a present supposition, when it becomes reality, is *indicative.*

The subjunctive mood undergoes no change of form throughout the same tense, and in it *be* is used instead of *am, are,* and *is;* and *were,* instead of *was.*

It is generally preceded by *if, lest, though, except, unless, whether, that, till,* or some like word.

The conditional word can generally be omitted by placing the verb or its auxiliary before the subject; as, *had* he, for *if he had.*

The **imperative mood** is used in commands, and may express —

Command; as, James, *stand* up.

Exhortation; as, *Be* just and *fear* not.

Entreaty; as, *Give* us this day our daily bread.

Permission; as, *Go* in peace.

The imperative mood is generally used only in the second person of the present tense; as, "*Let thou* and I the battle try"; *laugh ye* who can, *weep ye* who may.

Infinitives and *participles* are not now considered a mood.

TENSE.

Tense is that grammatical form of the verb which shows the distinctions of time.

An action is said to be *progressive* when it is represented as unfinished; *perfect,* when completed; and *indefinite,* when neither of these is stated; as, he *is reading,* he *has read,* he *reads.*

There are three divisions of time, — *present, past,* and *future;* and an action or event may be represented as going on, or as completed, in each of these periods; hence there are six tenses.

The *indicative* mood requires all the tenses, — the *present,* the *present-perfect,* the *past,* the *past-perfect,* the *future,* and the *future-perfect.*

The *potential* mood has only four tenses, — the *present,* the *present-perfect,* the *past,* and the *past-perfect.*

The *subjunctive* mood has three tenses, — the *present,* the *past,* and the *past-perfect.*

The *imperative* mood has one tense only, — the *present.*

The **present tense** generally represents present time, and in the **indicative mood** may denote, —

A present state or act; as, this is a wet day.

A present custom or habit; as, he drinks beer.

A constant truth; as, "Virtue is its own reward."

A future or past transaction, which is thereby presented with greater clearness or certainty; as, "But *see* where he flies on my desolate path!"

Something characteristic of an author, as noticed in his works now extant; as, Moore *is* full of sentiment and simile.

The **present subjunctive** implies future time; as, if he *live*, we shall be successful.

The **present potential** is either present or future as regards both the mood and the act or state; as, he *may be* here to-night; I *can see* him next Decoration Day.

The **present imperative** is future in regard to the act or state, and present in regard to the mood; as, *return* immediately.

The imperative mood has little to do with time, except that it has the form of the present tense, and expresses the will of the speaker with reference to the person addressed.

The **present-perfect** tense of the **indicative mood** may represent —

Something as completed in present time; as, I *have finished* the task.

Something as connected with present time; as, they *have been feeble* many years (and still continue so).

An act may be connected with present time, —

By the present existence of the actor; as, I *have* often *crossed* the channel (and, being still alive, I may cross it again).

By the act or state being continued to the present; as, thus *have* they *been persecuted* for years (and they are still persecuted).

By the existence of the result as present; as, Cæsar *has written* commentaries. (Cæsar is dead and the writing is past, but the commentaries still exist.)

By some important circumstance being present; as, many important bills have passed (this session).

The **present-perfect potential** presents the act or state as relatively past, and is present or future in regard to the mood; as, the horse *may have smashed* the carriage.

The **past tense** of a verb in the **indicative mood** denotes simply a past state or act; as, they *were singing* last evening.

A past custom or habit sometimes; as, the people *celebrated* more enthusiastically, and *spent* more lavishly, than now.

The **past-subjunctive**, as a rule, denies the act or state, and denotes present or indefinite time; as, if I *were* Alexander, I would do it.

The **past-potential** represents the act or state as real, denied, or contingent, and may be present, past, or future, in regard to both the act or state and the mood; as, he *would start* if he *could*.

A past habit or custom is sometimes denoted by it; as, there would he stand and meditate.

The **past-perfect tense** of the **indicative mood** represents something as finished or completed in past time; as, he had been loved.

In the **past-perfect subjunctive** or **potential**, the act or state is denied, and simply past time is denoted; as, if I *had seen* him, I *should have told* him.

A verb in the **future tense** expresses simply a future act or state; as, the heat *will melt* the snow.

Sometimes a future custom or habit; as, the lion and the lamb *shall lie* down together.

Future-perfect tense represents something as finished in future time; as, the work, when completed, *will have repaid* me for my labor.

GENERAL OBSERVATIONS.

The tenses of the subjunctive mood move forward in time, in order that they may be more readily distinguished from the tenses of the indicative; as, **subjunctive**, if *I be* (meaning hereafter); if I *were* (meaning now); *had* I *been* there (meaning of a certain past time): **indicative**, if I *am* (meaning now); if I *was* (meaning in past time); I *had been* there (meaning *previous* to a certain past time).

When used *subjunctively*, the tenses of the *potential* mood also move forward in time; as, I *should think* you *might try* it (meaning *now* or *hereafter*).

The use of the words *till*, *when*, *before*, *whoever*, *as soon as*, *whatever*, sometimes carries the present or present-perfect tense into future time, as, when he *arrives*, I shall depart.

INFINITIVES.

An infinitive is a form of the verb expressing the being, action, or state, but not affirming it; as *to learn, to hear.*

The infinitive generally begins with *to*, but this is dropped after the active voice of *bid, dare, let, need, make, see, hear*, and *feel.*

There are two forms of the infinitives; viz., the present and the perfect; as, *to be; to have been.*

The *present* infinitive expresses the simple act or state; as, *to love; to run;* passive: *to be loved.*

The *perfect* infinitive denotes the action or state as finished at the time spoken of; as, *to have loved; to have heard;* passive: *to have been heard.*

In the *present infinitive active*, after dropping the prefix *to*, the simplest form of the verb, called its *root*, remains.

PARTICIPLES.

The participle expresses the action or state, without declaring it, and is commonly of the nature of an adjective; as, *stating, loving.*

The participles are the *present*, the *perfect*, and the *compound.*

The *present* participle represents the act or state as going on at the time referred to; as, *coming* home.

This participle is formed by suffixing *ing* to the verb root; as, *stand, standing.*

The *perfect* participle represents the action or state as completed at the time to which reference is made; as, the hunter, *detained* by the accident, etc. This participle is regularly formed by suffixing *ed* to the verb root; as, *learn, learned.*

Compound participles are formed from both the present and the perfect by prefixing *being, having*, or *having been;* as, *being struck, having struck, having been struck.*

CONJUGATION.

The *conjugation* of a verb is the regular arrangement of its voices, moods, tenses, numbers, and persons. The *principal parts* of a verb are the *present* and *past tenses*, and the *present* and *perfect participles.* Conjugation is effected by changing the form of the verb, and by using auxiliary verbs.

The *auxiliaries* are, *be, do, have, shall, will, can, may, must.*

CONJUGATION OF THE AUXILIARY "BE."

PRINCIPAL PARTS.

Present, am; *Past*, was; *Present Participle*, being; *Perfect Participle*, been.

INDICATIVE MOOD.

	Singular.	*Plural.*
Present Tense.	1. I am,	1. We are,
	2. You are,	2. You are,
	3. He is;	3. They are.
Present-Perfect Tense.	1. I have been,	1. We have been,
	2. You have been,	2. You have been,
	3. He has been;	3. They have been.
Past Tense.	1. I was,	1. We were,
	2. You were,	2. You were,
	3. He was;	3. They were.
Past-Perfect Tense.	1. I had been,	1. We had been,
	2. You had been,	2. You had been,
	3. He had been;	3. They had been.

Future Tense.

	Singular.		*Plural.*
1.	I shall or will be,	1.	We shall or will be,
2.	You shall or will be,	2.	You shall or will be,
3.	He shall or will be;	3.	They shall or will be.

Future-Perfect Tense.

1.	I shall or will have been,	1.	We shall or will have been,
2.	You shall or will have been,	2.	You shall or will have been,
3.	He shall or will have been;	3.	They shall or will have been.

POTENTIAL MOOD.

Present Tense.

1.	I may be,	1.	We may be,
2.	You may be,	2.	You may be,
3.	He may be;	3.	They may be.

Present-Perfect Tense.

1.	I may have been,	1.	We may have been,
2.	You may have been,	2.	You may have been,
3.	He may have been;	3.	They may have been.

Past Tense.

1.	I might be,	1.	We might be,
2.	You might be,	2.	You might be,
3.	He might be;	3.	They might be.

Past-Perfect Tense.

1.	I might have been,	1.	We might have been,
2.	You might have been,	2.	You might have been,
3.	He might have been;	3.	They might have been.

SUBJUNCTIVE MOOD.

Present Tense.

1.	If I be,	1.	If we be,
2.	If you be,	2.	If you be,
3.	If he be;	3.	If they be.

Past Tense.

1.	If I were,	1.	If we were,
2.	If you were,	2.	If you were,
3.	If he were;	3.	If they were.

Past-Perfect Tense.

1.	If I had been,	1.	If we had been,
2.	If you had been,	2.	If you had been,
3.	If he had been;	3.	If they had been.

IMPERATIVE MOOD.

Present Tense.

	Singular.		*Plural.*
2.	Be thou or you.	2.	Be ye or you.

INFINITIVES.

Present.	*Perfect.*
To be.	To have been.

PARTICIPLES.

Present.	*Perfect.*	*Compound.*
Being.	Been.	Having been.

The *synopsis* of a verb is the arrangement of the forms of the different modes and tenses in a single number and person, as in third person singular of the verb *be*.

Indicative. —	Present Tense.	He is.
	Present-perfect Tense.	He has been.
	Past Tense.	He was.
	Past-perfect Tense.	He had been.
	Future Tense.	He shall or will be.
	Future-perfect Tense.	He shall or will have been.

CONJUGATION OF THE REGULAR VERB "LOVE."

PRINCIPAL PARTS.

Present, love ; *Past*, loved ; *Present Participle*, loving ; *Perfect Participle*, loved.

Indicative Mood.

Present Tense.

	Singular.		*Plural.*
1.	I love,	1.	We love,
2.	You love,	2.	You love,
3.	He loves ;	3.	They love.

Present-Perfect Tense.

1.	I have loved,	1.	We have loved,
2.	You have loved,	2.	You have loved,
3.	He has loved ;	3.	They have loved.

Past Tense.

1.	I loved,	1.	We loved,
2.	You loved,	2.	You loved,
3.	He loved ;	3.	They loved.

Past-Perfect Tense.

1.	I had loved.	1.	We had loved,
2.	You had loved,	2.	You had loved,
3.	He had loved ;	3.	They had loved.

Future Tense.

1.	I shall or will love,	1.	We shall or will love,
2.	You shall or will love,	2.	You shall or will love,
3.	He shall or will love ;	3.	They shall or will love.

Future-Perfect Tense.

1.	I shall or will have loved,	1.	We shall or will have loved,
2.	You shall or will have loved,	2.	You shall or will have loved,
3.	He shall or will have loved ;	3.	They shall or will have loved.

Potential Mood.

Present Tense.

	Singular.		*Plural.*
1.	I may, can, or must love,	1.	We may, can, or must love,
2.	You may, can, or must love,	2.	You may, can, or must love,
3.	He may, can, or must love ;	3.	They may, can, or must love.

Present-Perfect Tense.

1.	I may, can, or must have loved,	1.	We may, can, or must have loved,
2.	You may, can, or must have loved,	2.	You may, can, or must have loved,
3.	He may, can, or must have loved;	3.	They may, can, or must have loved.

Past Tense.

1.	I might, could, would, or should love,	1.	We might, could, would, or should love,
2.	You might, could, would, or should love,	2.	You might, could, would, or should love,
3.	He might, could, would, or should love ;	3.	He might, could, would, or should love.

Past-Perfect Tense.

Singular.	*Plural.*
1. I might, could, would, or should have loved,	1. We might, could, would, or should have loved,
2. You might, could, would, or should have loved,	2. You might, could, would, or should have loved,
3. He might, could, would, or should have loved;	3. They might, could, would, or should have loved.

SUBJUNCTIVE MOOD.

Present Tense.

1. If I love,	1. If we love,
2. If you love,	2. If you love,
3. If he love;	3. If they love.

Past Tense.

1. If I loved,	1. If we loved,
2. If you loved,	2. If you loved,
2. If he loved;	3. If they loved

Past-Perfect Tense.

1. If I had loved,	1. If we had loved,
2. If you had loved,	2. If you had loved,
3. If he had loved;	3. If they had loved.

IMPERATIVE MOOD.

Present Tense.

2. Love you or thou.	2. Love ye or you.

INFINITIVES.

Present.	*Perfect.*
To love.	To have loved.

PARTICIPLES.

Present.	*Perfect.*	*Compound.*
Loving.	Loved.	Having loved.

PASSIVE VOICE.

INDICATIVE MOOD.

Present Tense.

Singular.	*Plural.*
1. I am loved,	1. We are loved,
2. You are loved,	2. You are loved,
3. He is loved;	3. They are loved.

Present-Perfect Tense.

1. I have been loved,	1. We have been loved,
2. You have been loved,	2. You have been loved,
3. He has been loved;	3. They have been loved.

Past Tense.

1. I was loved,	1. We were loved,
2. You were loved,	2. You were loved,
3. He was loved;	3. They were loved.

Past-Perfect Tense.

1. I had been loved,	1. We had been loved,
2. You had been loved,	2. You had been loved,
3. He had been loved;	3. They had been loved.

Future Tense.

1. I shall or will be loved,	1. We shall or will be loved,
2. You shall or will be loved,	2. You shall or will be loved,
3. He shall or will be loved;	3. They shall or will be loved.

Future-Perfect Tense.

1. I shall or will have been loved,	1. We shall or will have been loved,
2. You shall or will have been loved,	2. You shall or will have been loved,
3. He shall or will have been loved;	3. They shall or will have been loved.

POTENTIAL MOOD.

Present Tense.

Singular.	*Plural.*
1. I may, can, or must be loved,	1. We may, can, or must be loved,
2. You may, can, or must be loved,	2. You may, can, or must be loved,
3. He may, can, or must be loved;	3. They may, can, or must be loved.

Present-Perfect Tense.

1. I may, can, or must have been loved,	1. We may, can, or must have been loved,
2. You may, can, or must have been loved,	2. You may, can, or must have been loved,
3. He may, can, or must have been loved;	3. They may, can, or must have been loved.

Past Tense.

1. I might, could, would, or should be loved,	1. We might, could, would, or should be loved,
2. You might, could, would, or should be loved,	2. You might, could, would, or should be loved,
3. He might, could, would, or should be loved;	3. They might, could, would, or should be loved.

Past-Perfect Tense.

1. I might, could, would, or should have been loved,	1. We might, could, would, or should have been loved,
2. You might, could, would, or should have been loved,	2. You might, could, would, or should have been loved,
3. He might, could, would, or should have been loved;	3. They might, could, would, or should have been loved.

SUBJUNCTIVE MOOD.

Present Tense.

Singular.	*Plural.*
1. If I be loved,	1. If we be loved,
2. If you be loved,	2. If you be loved,
3. If he be loved;	3. If they be loved.

Past Tense.

1. If I were loved,	1. If we were loved,
2. If you were loved,	2. If you were loved,
3. If he were loved;	3. If they were loved.

Past-Perfect Tense.

1. If I had been loved,	1. If we had been loved,
2. If you had been loved,	2. If you had been loved,
3. If he had been loved;	3. If they had been loved.

IMPERATIVE MOOD.

Present Tense.

2. Be thou or you loved.	2. Be ye loved.

INFINITIVES.

Present. To be loved.	*Perfect.* To have been loved.

PARTICIPLES.

Present. Being loved.	*Perfect.* Loved.	*Compound.* Having been loved.

In the English language all verbs, except about two hundred, are regular, and conjugated like *to love.*

FORMS OF THE TENSES.

In addition to the common form of tense, several special forms are employed to express particular meanings.

These are, the *emphatic*, the *progressive*, the *ancient*, and the *interrogative.*

The *emphatic* form denotes emphasis.

It is found only in the present and past indicative active and in the imperative, and is formed by joining *do* or *did* to the verb; as, I *did* study; you *do* know.

The *progressive* form denotes a continuance of the action or state, and is formed by combining some part of *to be* with the present participle of the verb; as, I *am writing;* he *is walking.*

The *ancient* form usually denotes solemnity, and is found in the Bible, in religious writings, and in poetry.

It is formed by using the ending *t*, *st*, or *est*, in the second person singular; and *th* or *eth* in place of *s* or *es* in the third person singular; and by using *thou* or *ye* instead of *you*; as, "He *doeth* all things well."

The *interrogative* form is employed in asking questions, and is formed by placing the verb, or a part of it, before the subject; as, *have* you *been* to Boston?

ADVERBS.

The word "adverb" is from the two Latin words *ad* and *verbum*, meaning something added to a verb; and an adverb is a word used to modify or limit the meaning of a verb, adjective, participle, or other adverb.

Adverbs are divided, according to their use, into four classes; viz., *simple*, *conjunctive*, *interrogative*, and *modal*

A *simple* adverb merely modifies the word in connection with which it is used; as, she is *always* singing.

A *conjunctive* adverb gives to a dependent clause an adverbial relation, and connects it with the word which it limits; as, I shall have reached home *when* the sun rises.

An *interrogative* adverb is one used in asking questions; as, *when* shall we three meet again?

A *modal* adverb is one which modifies the sentence as a whole, and not any particular word; as, *perhaps* you will forget.

The principal modal adverbs are, *surely*, *doubtless*, *verily*, *truly*, *yea*, *forsooth*, *certainly*, *nay*, *not*, *possibly*, *perhaps*, *probably*, *perchance.*

Abverbs are again divided, according to their meaning, into five general classes; viz., adverbs of place, adverbs of time, adverbs of cause, adverbs of manner, and adverbs of degree.

Adverbs of *place* answer the questions, *where? whither? whence?* as, *yonder*, *there*, *here*, *upwards*, etc.

Adverbs of *time* answer the questions, *when? how long? how often?* as, *yesterday*, *continually*, *often frequently*, etc.

Adverbs of *cause* answer the questions, *why? wherefore?* as, *therefore*, etc.

Adverbs of *manner* answer the question, *how?* as, *faithfully*, *well*, *truly*, etc.

Adverbs of *degree* answer the questions, *to what extent? how much?* as, *much*, *little*, *more*, *enough*, etc.

The words *yes* and *no*, sometimes called *responsives*, were originally derived from adverbs, and the former is equivalent to a repetition of the question as an affirmative sentence; while the latter is equivalent to a repetition of the question as a negative sentence.

Examples: *Will you write? Yes*, equivalent to *I will write*; or *No*, equivalent to *I will not write.*

An *adverbial phrase* is two or more words connected and used adverbially; as, *in vain*, *in short*, *out and out*, etc.

The, in such expressions as, *the* older *the* wiser, *the* sooner *the* better, etc., is not the definite article *the*, but an adverbial *the*, equivalent to *in what degree*, and *in that degree*; as, *in what degree* older, *in that degree* wiser.

COMPARISON.

Many adverbs, like adjectives, admit of comparison; and the comparative and superlative degrees are regularly formed in the same manner; as, *soon*, *sooner*, *soonest*; *wisely*, *more wisely*, *most wisely.*

A few adverbs, like the adjectives with which they correspond, are compared irregularly; as, *well*, *ill*, *badly*, *little*, etc.

PREPOSITIONS.

A *preposition* is a word showing a relation of meaning between the noun, or pronoun depending on it, which is called its object, and some other word; as, she has passed *beyond* the river.

The word "preposition" is from the two Latin words *prae* and *pono*, literally meaning *to place before*, and so called from the fact that the prepositions were originally prefixed to verbs.

An *adjunct* is a preposition and its object, or the words required to complete the sense.

There are about seventy-five prepositions in the English language, of which the following are the principal ones: —

Aboard, about, above, according to, across, after, against, along, amid or amidst, among or amongst, around, at, athwart, before, behind, below, beneath, beside or besides, between, betwixt, beyond, by, concerning, down, during, except, excepting, for, from, in, into, 'mid, 'midst, notwithstanding, of, off, on, out of, over, pending, past, regarding, respecting, round, since, through, throughout, till, to, touching, toward, towards, under, underneath, until, unto, up, upon, within, without.

CONJUNCTIONS.

The word "conjunction" is derived from the two Latin words *con* and *jungo*, meaning *to join together*. A conjunction is a word used to join together sentences and parts of sentences; as, the boy came for a visit *and* Henry showed his new pony; James *and* his dog are playing.

Conjunctions are divided, according to their use, into two classes; viz., *coördinate* and *subordinate.*

A *coördinate* conjunction connects two independent or two dependent propositions, or words, or phrases, having the same grammatical relation to some other word; as, the winds *and* the waves govern the ocean. The principal coördinate conjunctions are *and, both, but, either, neither, nor, or, whether.*

When two conjunctions are used to connect the same parts and have a mutual relation, they are called *correlatives;* as, *both* Herbert *and* Mattie; *neither* north *nor* east.

A *subordinate* conjunction connects a dependent to a principal proposition; as, I came *because* you requested it. The following are the principal subordinate conjunctions: *after, although, because, before, except, for, if, lest, notwithstanding, since, that, though, till, unless, until.*

INTERJECTIONS.

An *interjection* is a word which expresses some sudden emotion of the mind, and has no grammatical relation to the remainder of the sentence.

The following are the principal interjections: *ah! alas! alack! fie! hey! hurrah! hallo! pshaw! tush! hist! hush! O!* etc.

SYNTAX.

Syntax treats of the construction and analysis of sentences.

Analysis, in grammar, is the separating of a sentence into its elements, or principal and subordinate parts.

A sentence is a thought expressed by a proposition, or a union of propositions, so joined as to make complete sense.

A sentence may consist of a word or phrase only, equivalent to a proposition; as, *certainly, yes.*

A proposition is a combination of subject and predicate forming a sentence.

Propositions are either *declarative, interrogative, imperative,* or *exclamatory.*

A *declarative* proposition is one in which something is affirmed or declared; as, the boy ran.

An *interrogative* proposition is one asking a question; as, who was the man?

An *imperative* proposition is expressing a command, entreaty, or permission; as, put away your work.

An *exclamatory* proposition expresses some sudden emotion of the mind; as, how art thou fallen!

A **clause** is a proposition making but a part of a sentence; as, the birds sang; the bees hummed; and daisies covered the fields. In the foregoing sentence there are three clauses.

Every proposition must, at least, have two principal parts, — a *subject-nominative* and a *predicate-verb.*

The **Subject nominative** must be a noun, a pronoun, or an equivalent expression, that is the nominative to the verb

The **Predicate-verb** is the one which predicates an act or state of the subject; as, —

> "Man's inhumanity to man
> *Makes* countless thousands mourn."

Every proposition must have a *subject* and a *predicate.*

A **Subject** represents that of which something is stated; as, the *fruit* is good.

The **Predicate** represents that which is stated of the subject; as, Henry *is coming.*

Subjects and predicates are either *simple* or *compound.*

A *simple* subject has but one subject-nominative to the same verb.

A *compound* subject has two or more subject-nominatives to the same verb.

A *simple* predicate has only one predicate-verb belonging to the same subject; as, flowers bloom.

A *compound* predicate has two or more predicate-verbs belonging to the same subject; as, England and Ireland are allied, and governed as one kingdom.

The entire or qualified subject is sometimes called the *logical subject*, and the entire or modified predicate the *logical predicate.*

The *copula* is the predicate-verb *be*, or any other neuter verb.

The *attribute* is the adjective, noun, or kindred expression which comes after the copula. The copula and attribute constitute the logical predicate.

The elements of a sentence are its component parts. They are divided, according to their *rank*, into three classes; viz., principal, subordinate, and independent.

Principal elements are the words required for the expression of a thought. The principal elements of a sentence are the subject and predicate; and they always govern the subordinate.

Subordinate elements are words joined to the principal elements to express some modification of the thought, and they always limit or qualify the principal.

An **independent** element is a word or phrase having no grammatical relation to the remainder of the sentence; as, *James*, it is time to go to school.

When two elements of the same kind are united they are called *coördinate;* but they do not, in any way, govern or modify each other; as, it was a terrible blow to my *mother* and *me*.

Elements are again divided, according to their use, into *two modifying elements*, a *connecting element*, and *an independent* or *substantive element*.

A *modifying element* is a word, phrase, or clause added to some other word or phrase to vary the meaning. They are either *adjective* or *adverbial*.

An **adjective modifier** is a word, phrase, or clause used as an adjective; as, the place *where Moses was buried* is unknown.

An **adverbial modifier** is a word, phrase, or clause used as an adverb; as,

> "But the lawyers smiled that afternoon
> *When* he hummed in court an old love-tune."

An **adjective** or an **adverb** may have the same modifiers as a verb, except those modifiers which are substantive or adjective.

A modifying word may itself have two or more modifiers; as, the man who worked most industriously got the reward. *Man* is qualified by the clause *who worked most industriously*, and *worked* is itself modified by *most diligently*.

The *connecting elements* are conjunctions, prepositions, relative pronouns, and some adverbs. They may consist of one word only or a phrase; they may be expressed or understood; used singly or in pairs.

The *independent* or *substantive element* may be a word, phrase, or clause used as a noun; or it may be an interjection or an adverb, or may represent an entire sentence or part of a sentence; as, *to study* is profitable.

Elements are again divided, according to their form, into five classes: —

Simple; as, a tall man.

Complex; as, a man *of the city*.

Compound; as, in sunshine and in storm.

Propositional; as, between them and the person whom they engaged.

Mixed; as, of the general features of the country, its mountains, lakes, and rivers, its climate and productions, we write.

Clauses may be divided, according to their form, into three classes: —

Simple, when they have but one predicate.

Complex, when they include both a principal and a dependent clause.

Compound, when they include two coördinate clauses.

A clause, in its grammatical nature, may be substantive (nominative, objective, explanatory, or appositive), relative, adverbial, or conjunctive. In its logical nature, a clause may be substantive, adjective, or adverbial.

SIMPLE SENTENCES.

A *simple sentence* consists of only one principal proposition, and has no subordinate proposition; as, the snow will melt. The subject is *snow*, and the predicate is *will melt*.

In all sentences, the essence of syntax is *predication*.

Analysis of a simple sentence with *object* added to the predicate-verb; as, hens lay *eggs*. The subject is *hens;* the whole predicate is *lay eggs;* and the predicate verb is *lay*, which is limited by the object *eggs*.

Analysis of a simple sentence with *an article* or *adjective* added to the subject or object; as, *the dog* was killed. The whole subject is *the dog;* the subject-nominative is *dog*, which is qualified by the article *the;* and *was killed* is the predicate.

Analysis of a simple sentence with adjective or *nominative* added to the predicate-verb; as, feathers are *light*. The subject is *feathers; are light* is the predicate; and *are* is the predicate-verb, which is combined with *light*, an attribute of the subject.

Analysis of a simple sentence with *adjunct* added to the predicate-verb; as, the storm swept *over the mountain*. The subject is *the storm;* the subject-nominative is *storm*, which is qualified by the article *the; swept over the mountain* is the predicate; *swept* is the predicate-verb, which is modified by the adjunct *over the mountain*.

Analysis of a simple sentence with *adjunct* added to the *subject* or *object;* as, spots *of blood* covered his body. The whole subject is *spots of blood;* the subject-nominative is *spots*, which is qualified by the adjunct *of blood; covered his body* is the entire predicate; *covered* is the predicate verb, which is modified by the object *body*, and *body* is qualified by the possessive *his*.

Simple sentences with *possessive* or *appositive* added to subject or object; as, my coat is black.

Simple sentences with adjuncts; as, time is called *the warp of life;* I gave *him* some prudent advice.

Simple sentences with participial or absolute phrases; as, *the family being wealthy*, he bought the mansion; they retreated, *pursued by our soldiers*.

Simple sentences with infinitive phrases; as, I went to the shore *to pick up shells;* the sun makes the snow *melt quickly*.

Simple sentences having compound subjects; as, *patience* and *perseverance* overcome all difficulties; "*Angels* and *ministers* of grace, defend us!"

Simple sentences having compound predicates: —

> "*Talked* o'er his wounds, and deeds of glory done,
> *Shouldered* his crutch, and *showed* how fields were won."

Simple sentences having compound modifiers; as, he journeyed to California, *partly by land and partly by water*.

Simple sentences having independent parts: —

> "Emblem of eternity!
> Unbeginning, endless sea!
> Let me launch my soul on thee."

COMPLEX SENTENCES.

A complex sentence contains one principal clause, and one or more subordinate clauses, and also includes those sentences that have two clauses connected by a relative pronoun, a conjunctive adverb, a subordinate conjunction, and those in which one clause takes the part of a noun, an adjective, or an adverb. Subordinate clauses can be used as nouns in any case but the possessive.

Nominative clauses. — *That Shakespeare wrote Hamlet* is doubted by many critics. This is a complex sentence, having a subordinate clause for the subject. *That Shakespeare wrote Hamlet* is the principal subject; and *is doubted by many critics* is the principal predicate. *Is doubted* is the predicate-verb, which is modified by the adjunct *by many critics*. The connective, showing the dependence of the subordinate clause on something else, is *that*. *Shakespeare*, of the dependent clause, is the subject.

Apposite explanatory clauses. — It is generally doubted *that Shakespeare wrote Hamlet*. This is a complex sentence having the dependent clause in apposition with the subject. The whole principal subject is *It*, with the clause *that Shakespeare wrote Hamlet*. *It* is the subject-nominative qualified by the explanatory clause; *is doubted* is the predicate-verb, and *is generally doubted* is the principal predicate.

Objective clauses. — All critics doubt *that Shakespeare wrote Hamlet*. The object in this complex sentence is a dependent clause. *Critics* is the subject-nominative qualified by *all*, and *all critics* is the principal logical subject. The predicate-verb is *doubt*, which is limited by the objective clause *that Shakespeare wrote Hamlet*. The whole principal logical predicate is *doubt that Shakespeare wrote Hamlet*.

Predicate explanatory clauses. — The cause of wonder was, *why he did not write*. A dependent clause is here introduced as a predicate-nominative, which explains the subject. *Was* is the predicate verb, and *was why he did not write* is the principal predicate.

Relative clauses having antecedents expressed. — The person who *utters slander* is criminal. This sentence has a dependent clause used as an adjective. The subject-nominative is *person*, which is qualified by the relative clause *who utters scandal*, and the article *the*. The whole principal logical subject is, *the person who utters slander*. *Is criminal* is the principal logical predicate. *Is* is the predicate-verb; and it is joined with the predicate adjective *criminal*. The dependent clause is joined to *person* by *who*, which is also the subject of the dependent clause. *Utters* is the predicate-verb modified by its object *scandal*, and *utters scandal* is the predicate.

Relative clauses without antecedents. — I will not demur to *what is fair*. The grammatical adjunct is *to what*, and the whole adjunct is *to what is fair*. *What* is the grammatical object, which is modified by the incorporated predicate of which it is also the subject.

Dependent adverbial clauses. — Adverbs of time. *When the rain falls*, vegetation quickens. The principal clause is *vegetation quickens*. The dependent clause is *when the rain falls*, which modifies the predicate of the principal clause in the sense of an adverb of time. The two clauses are connected by the conjunctive adverb *when*.

Adverbs of place. — We placed the money *where the people were naked and helpless*. *Where the people were naked and helpless* is the dependent clause, which modifies *placed*.

Adverbs of manner. — *As is the schoolmaster*, so will be the school *So* in this sentence expresses manner, which the dependent clause explains.

Adverbs of degree. — I am as good *as he*. The principal clause is, *I am as good*. The dependent clause is *as he*, which modifies the phrase *as good*.

Modal adverbs. — The man will succeed *because he has energy*. The principal clause is *the man will succeed*; the dependent clause is *because he has energy*, which modifies *will succeed*.

Complex sentences, as a rule, can be made compound by the addition of similar words, phrases, or clauses; and any part can be made complex by the addition of modifiers. It is in this way that long, complex sentences are generally produced.

COMPOUND SENTENCES.

A compound sentence contains two or more propositions or simple sentences, and may consist of —

Two clauses connected by a coördinate conjunction; as, the roads were wet and the travelling bad.

Two clauses that have no connective; as, temperance promotes health; intemperance destroys it.

Two or more complex sentences; as, my vices you may denounce and contemn; my virtues you must laud and appreciate.

Two or more compound sentences; as, —

> "They rally, they bleed, for their kingdom and crown;
> Woe, woe to the riders that trample them down!"

A mixture of simple, complex, and compound sentences; as, time is brief and the task is difficult, therefore a regard for self prompts me not to undertake it.

Compound sentences may be, —

Copulative; as, the horse was bought, *and* also the harness.

Disjunctive; as, you may go on with your work, *or* you may sit idle.

Adversative; as, he is a prudent man, though he acted injudiciously in this case.

Illative; as, the soldiers retreated; therefore they were beaten.

Parenthetic; as, a thief — I care not how he entered — stole my watch.

All classes of sentences are often contracted or abridged.

Compound sentences, where the clauses have the same predicate, may be changed to a simple one having a compound subject; or, when the clauses have the same subject, they may be united in one sentence with a compound predicate; or, when the clauses have the same subject and predicate-verb, the repeated parts may be omitted.

Examples. — Gold is found in these mountains, and silver is found in these mountains. Gold and silver are found in these mountains.

The waves swept over the deck, and the waves carried two men overboard. The waves swept over the deck and carried two men overboard.

It was a well-organized army; it was a disciplined army; it was an invincible army. It was a well-organized, disciplined, and invincible army.

A *complex sentence* with a substantive clause, in its abridged form, is usually an infinitive phrase; with an adjective clause it may be an adjunct or adjective, a participial phrase, an infinitive phrase, or an absolute phrase.

EXAMPLES. — *That I may finish it myself* is my desire. *To finish it myself* is my desire.

Our pew, *which is in the church.* Our pew *in the church.*

The bottle *which contains the wine.* The bottle *containing the wine.*

A book *that may please you.* A book *to please you.*

An *adverbial clause* may be abridged as an adjunct, a participial phrase, an infinitive phrase, or an absolute phrase.

EXAMPLES. — You will lose your money *if you frequent there.* You will lose your money *by frequenting there.*

When I had finished my labor, I went for a walk. *Having finished my labor,* I went for a walk.

I have come *that I may teach you.* I have come *to teach you.*

When Napoleon had conquered Austria, Russia prepared for defence. *Napoleon having conquered Austria,* Russia prepared for defence.

The verb *be* and the pronoun are often omitted together, and often the prominent part of the dependent clause only is retained.

EXAMPLE. — It is much better read *than written;* meaning, than *it is* written.

If the subordinate clause has the same subject with the principal clause, the subordinate usually loses its subject by contraction; but, when the principal and the subordinate clauses have different subjects, the subject of the subordinate clause is usually retained.

EXAMPLES — I came that I might teach you. I came to teach you.

I expect that *he* will attend. I expect *him* to attend.

Simple sentences are contracted by retaining only the most important part, and the verb *be* is often omitted in all its forms.

EXAMPLE. — This having been done, we went our way. This done, we went our way.

PARSING.

Parsing is naming a part of speech, and showing its relation to other words in a sentence.

The **relation** of one word to another is its reference to it in sense.

A **grammatical rule** is a brief statement of the relation which words bear to each other in a sentence.

NOUNS AND PRONOUNS.

The house is large.

This is a simple declarative sentence, in which *house* is the subject, and *is large* is the predicate.

House is a *noun; common,* because it is a name common to all things of the same kind; *neuter gender,* because it is neither a male nor a female; and in the *nominative case,* being the subject of an affirmation to the verb *is.*

NOMINATIVES.

RULE 1. — A **noun** or **pronoun** used as the subject of a propositon is put in the nominative case.

We saw them.

In this simple declarative sentence the subject is *we; saw them* is the predicate; and *saw* is the predicate-verb, which is limited by the object *them.*

We is a *personal pronoun,* because it stands for persons and is used instead of a noun; *common gender,* because it may represent either males or females; *first person,* because it stands for the person speaking; *plural number,* it means more than one; and in the *nominative* case, being the subject of the verb *saw,* according to Rule 1.

John, your task is finished.

In this sentence *John* is simply addressed, and the remainder of the sentence would make sense without the name *John;* hence *John* is said to be in the *nominative* case *independent.*

The *wind* being favorable, we set sail.

The noun *wind* being connected with the participle *being,* and having no relation with any other word, it is said to be in the *nominative absolute.*

Rule 2. — When a **noun** or **pronoun** is used independently or absolutely, it is in the nominative case.

"*Sweet Auburn!* loveliest village of the plain."

Sweet Auburn is in the nominative independent, as it is directly addressed.

He is the *man.*

In this sentence there is an evident relation between *he* and *man,* and both being in the same case, *he* is the subject-nominative of the verb *is,* while *man* is the predicate-nominative after the same verb.

Rule 3. — A **noun** or **pronoun** used in the predicate, meaning the same person or thing as the subject, agrees with it in case.

When no verb joins the terms meaning the same person or thing, they are said to be in *apposition;* as, *Sumner,* the *senator* from Massachusetts.

William's book is torn.

In this declarative sentence *William's book* is the logical subject, and *is torn* is the predicate. *Book,* being the principal word, is the *subject-nominative,* qualified by *William's.*

William's is a *proper noun,* it being the name of a particular person; *masculine gender,* denoting a male; *third person,* being the person spoken of; singular number, meaning but one; possessive case, limiting the meaning of the noun *book.*

Book is parsed same as *house,* under Rule 1.

Rule 4. — A **noun** or **pronoun** used to denote possession is put in the possessive case.

William's book is on *my* table

In this sentence *my* is a *personal pronoun; first person,* as it means the person speaking, *singular number,* denoting only one; *common gender,* it may be either a male or female; and in the *possessive case,* limiting the noun *table.*

Henry struck the *horse.*

In this sentence *Henry,* the *subject,* struck something, the *horse. Horse* is, therefore, the *object* of the predicate-verb *struck,* and in parsing is said to be in the objective case.

Rule 5. — A **noun** or **pronoun** used as the object of a transitive verb is put in the objective case.

He killed *him.*

Him is a *personal pronoun; third person,* being spoken of; *singular number,* meaning one; *masculine gender,* denoting a male; and in the *objective case,* being the object of the transitive verb *killed.*

He is beyond the mountains.

In this simple declarative sentence *he* is the subject-nominative, *is beyond the mountains* is a *predicate,* and *is* is the predicate verb. *Mountains* is the object of the preposition *beyond. Beyond* something, — *beyond* the *mountains;* hence the relation between them.

Mountains, a *common noun,* being the name of no particular mountain; *plural number,* denoting more than one; *neuter gender,* being neither male nor female; and in the *objective case,* being the object of the preposition *beyond.*

Rule 6. — A **noun** or **pronoun** used as the object of a preposition is put in the objective case.

He walked a *mile.*

In this sentence there is a connection or relation between *walked* and *mile.* The meaning conveyed by the verb *walked* is limited by *mile,* which shows the extent of his walk; and there is a governing word understood; as, walked *for* a mile, or the distance *of* a mile.

Rule 7. — A **noun** or **pronoun** used to limit the meaning of a verb, adjective, or adverb, without a preposition expressed, is put in the objective case.

Give *me* the book.

Me is a *personal pronoun, first person, singular number,* and in the *objective case,* being the object of the preposition *to,* understood: Give (to) *me* the book.

I heard *what* was done.

What is a *relative pronoun* because it has a dependent clause; *neuter gender,* denoting neither a male nor a female; *third person,* representing the thing spoken of; *singular number,* meaning only one; and is the object of the verb *heard* and the subject of *was done,* it being considered equivalent to *that which.* I heard *what* (*that which*) was done.

Rule 8. — The pronoun **what,** when it includes a relative and its antecedent, has two cases.

The relative must take the form required for its own clause when it does not allow the two cases, and in parsing the antecedent must be supplied.

James has found *his* book.

The pronoun *his* is of the same gender as *James,* otherwise it could not denote James; and also, for the same reason, it is of the same number and person.

Rule 9. — A **pronoun** agrees with its antecedent in gender, number, and person.

He wrote works *which* made him famous.

Which is a *relative pronoun* having *works* for its antecedent, and joined to the clause *made him famous;* neuter gender, third person, and plural number, agreeing with *works; nominative case,* being the subject of the verb *made.* (See Rule 1.)

ARTICLES, ADJECTIVES, AND PARTICIPLES.

A black horse with a long mane.

There being no proposition stated, the above is only a phrase. The subject is *horse,* which is limited by the article *a,* the adjective *black,* and the adjunct *with a long mane.* The article *a* and the adjective *long* qualify *mane,* and *horse* and *mane* are joined by the preposition *with.*

Black is an adjective qualifying *horse,* of the positive degree (compare it). *Long* is an adjective of the positive degree qualifying *mane.* The former is a *descriptive* adjective, the latter a *definitive.*

Rule 10. — An **article,** an **adjective,** or a **participle** belongs to the noun or pronoun to which it relates.

The lofty mountain.

In this phrase the principal word, *mountain,* is limited by the article *the,* also by the adjective *lofty.*

The is a definite article, showing that a particular mountain is referred to; and, according to Rule 10 above quoted, it belongs to *mountain.* *Lofty* is a descriptive adjective, *positive degree* (compare it), and qualifies *mountain.*

The house is *large.*

Here *large* evidently belongs to *house,* the sentence being equivalent to *it is a large house;* hence an adjective used as the *attribute* of a proposition after the verb *to be,* or an intransitive or passive verb, belongs to the subject.

When two or more connected nouns stand for the same person or thing, and the article is placed only before the first, it belongs to them jointly: —

I read Johnson, the poet and philosopher.

The mistress, (the) maid, and (the) driver were killed.

VERBS.

James *writes.*

In this sentence James does something,— he *writes,* and, as a consequence, there is a relation between *James* and *writes.* We could not properly say *James write,* or *ducks swims.* The form of the verb which agrees with the subject in person and number must be used.

Writes is a *verb,* the principal parts of which are, — present, *write;* past, *wrote;* present participle, *writing;* perfect participle, *written.* It is *irregular; transitive,* must have an object, — he writes something; *indicative mood,* it affirms something; *active voice, present tense, third person,* and *singular number,* to agree with its subject *James.*

Rule 11. — A **finite verb** agrees with its subject in person and number.

It *was sold* yesterday.

Was sold is an *irregular verb, passive voice, indicative mood, past tense, third person,* and *singular number,* to agree with its subject *it.*

INFINITIVES AND PARTICIPLES.

We were pleased *to remain* all day.

In this sentence *to remain* limits the verb *pleased.* It shows at what we were pleased, and, as a consequence, depends on *were pleased.*

To remain is an *infinitive,* intransitive, active voice, present tense, and depends on *were pleased.*

Rule 12. — An **infinitive** is governed by the word which it limits.

An *infinitive*, *participle*, or *phrase* can be used as a noun in any case but the possessive.

Not *to be killed* is fortunate.

To be killed is an infinitive used as a noun. As such, it is of the *neuter gender*, *third person*, *singular number*, and, with *not*, is the subject of the verb *is*.

The moon *having risen*, we ventured to sea.

The participle *having risen* merely expresses, but does not predicate, the act or state. It is *compound*, because *having* is joined to another participle; intransitive, not having any object; and perfect, since the act or state is represented as completed at the time referred to; and it belongs to *moon*.

I rely on speaking the part.

Speaking is a participial noun, from the verb *speak*. As a *noun*, it is third person, singular number, neuter gender, and objective case, governed by the preposition *on*. (See Rule 6.) As a *participle*, it is in the active voice, present, and is transitive.

Rule 13. — The **participle** has the construction of a noun and adjective, and is limited like a verb.

ADVERBS.

He rides *well*.

Well is an adverb of manner, modifying the verb *rides*. It is irregular in comparison, — *well*, *better*, *best*.

Her voice was *very* clear.

Very is an adverb modifying the adjective *clear*. How clear? *Very* clear.

The boy ran *very fast*.

Very is an adverb modifying the abverb *fast*. *Fast* modifies the verb ran. He ran *fast*. How fast? *Very* fast.

Rule 14. — An **adverb** modifies a verb, an adjective, or another adverb.

PREPOSITIONS.

In a sentence containing a preposition, when the adjunct is *adjective*, the preposition shows the relation existing between its object and some preceding noun or adjective; as, —

Men *of* strong minds are temperate in action.

Here the adjunct is *adjective*, it being equivalent to *strong-minded men*; and the preposition *of* shows the relation between its object *minds* and the noun *men*.

When the adjunct is *adverbial*, the preposition shows the relation existing between its object and the antecedent term, which may be a verb, adverb, participle, or even an infinitive phrase or clause; as, —

The earth moves *round* the sun.

The preposition *round* in this sentence shows the relation between *moves* and *sun*.

Rule 15. — **Prepositions** show the relation of words, and govern the objective case.

CONJUNCTIONS.

John and James were present.

And is a copulative conjunction. It is also coördinate, since it connects parts of equal rank, *John* and *James*.

You can *neither* disperse the meeting *nor* arrest the speakers.

Neither is a correlative conjunction, keeping *nor* to connect *disperse* and *arrest*.

Nor is a disjunctive conjunction, also coördinate, and it connects the two phrases.

Rule 16. — **Conjunctions** connect words, phrases, or sentences.

INTERJECTIONS.

O Death! where is thy sting?

Interjections are usually followed by the exclamation-point, and are not connected in construction with any other word.

Rule 17. — The **interjection** has no grammatical relation to the remainder of the sentence.

FALSE SYNTAX.

The errors in speaking and writing are included in the following: The use of superfluous words; an insufficiency of words; the improper use of words; words improperly arranged.

THE USE OF SUPERFLUOUS WORDS.

RULE. — No word or expression should be used that is not actually necessary to clearly and correctly express the meaning.

He understands the business, but you do not *understand the business.*

The words in *italics* are evidently superfluous. The meaning intended to be expressed is correctly and clearly stated in the sentence ending with the word *not.*

I went to him *for* to conclude the business.

For is not now allowed before the infinitive.

All *of* my life.

The love of friends, *the love* of home, *the love* of country.

His face is covered *over* with freckles.

I heard him *to* say it.

To is omitted after the verbs *bid, make, need, see, hear, feel, dare;* and sometimes after *have, please, keep, find;* as, you need not *to* have said; you need not have said.

RULE. — When the antecedent alone expresses the meaning clearly, the pronoun should not be added to it; as, James *he* read; and John *he* read.

RULE. — Double comparatives and superlatives are improper; as, the *more* wiser; he is the *most* strongest one of the family.

RULE. — When two negatives are equal to an affirmative, only one should be used to express negation; as, I don't know *nothing* about it: this really means I know something about it; he will never be *no* bigger.

RULE. — When words are connected which describe the same person or thing, the article is used only before the first of the words.

The article should be omitted when its repetition would imply more objects than are meant; as, John married a virtuous and a distinguished woman.

When it is necessary to show that the objects are separate or distinct, the article is inserted; as, Garfield, the scholar, the statesman, and the orator, was present.

RULE. — The insertion of a needless preposition often makes transitive verbs intransitive; as, many of his followers have deserted *from* him; his income will not admit *of* such expenditures.

RULE. — The same word or sound should not recur too frequently; as, I think that he is the person *that* I met.

The word *whom* substituted for *that* would make the sentence less harsh, and relieve the monotony or sameness of expression.

William's brother's house was burnt.

This sentence would be more elegantly expressed by saying, the house of William's brother was burnt.

AN INSUFFICIENCY OF WORDS.

RULE. — No word that is necessary to clearly and forcibly express the meaning should be omitted; as, you think him smarter than I.

This sentence may mean that you think him smarter than *I think him,* or smarter than *I am.*

He despises who despise him.

The object of the verb *despises* (those) should be supplied.

RULE. — In comparision, in order to keep the leading term from being compared with itself, the words *other, else,* etc., must sometimes be inserted; as, he imagines he can do it better than anybody (else); that boy is sharper than all the (other) boys in the school.

RULE. — When descriptive connected words refer to different persons or things, an article is usually placed before each of the words; as, the lame and (the) blind were well cared for.

RULE. — When you wish to distinguish some parts emphatically, or to keep them distinct in the mind, they should be expressed with uniform fulness; as, both the time and (the) place were settled; neither my legs nor (my) arms were injured.

RULE. — Parts following each other in serial order should be expressed with uniform fulness; as he is a person of experience, of integrity, and of candor.

RULE. — It is usually proper to state the subject-nominative, unless when the verb is in the imperative mood; as, it was this (which) led me to doubt him; he was a person (who) had no judgment.

RULE. — Participial nouns usually have an article before them, and the preposition *of* after them, or they may have both omitted; as, by (the) exercising (of) our muscles they are developed.

THE IMPROPER USE OF WORDS.

EXAMPLES HAVING ERRORS IN THE USE OF VERBS AND NOUNS: —

Lay down and sleep. This should be *lie*, *lay* being the past tense of the verb.

We *set* up late that night. The verb should be *sat*, the past tense of the verb *sit*.

Henry *favored* the journey to his uncle's house because he remembered that Fanny *favored* her cousin in countenance.

The repetition of the word "favored" in different senses in the same sentence is improper, and "resembled," or some such word, should be substituted.

EXAMPLES OF THE IMPROPER USE OF PRONOUNS AND ADJECTIVES: —

Take either of the four.

Either can only be properly used when two are spoken of, and *any* should be substituted.

Neither one of the four was right.

Neither and *each other* can be used where only two are spoken of.

John and James struck *one another*.

This should be *each other*, *one another* being used when more than two are spoken of.

EXAMPLES OF ERRORS IN THE USE OF ADVERBS AND CONJUNCTIONS: —

Neither money *or* clothing was wanted.

Or should be *nor*, the proper correlative of *neither*.

I told him about a month *since*.

Since denotes from some past time forward, and *ago* from the present time backward.

There was no one *else* but him present.

Else in this sentence is superfluous, and should be dropped.

EXAMPLES OF ERRORS IN THE USE OF PREPOSITIONS: —

He left my book (to) home.

In the above sentence, the preposition *at* should be used instead of *to*.

The thunder was followed *with* rain.

Should be *by* rain.

You may depend *in* what I say and rely *in* his honesty.

In the preceding sentence *in* should be *on*.

APPLICATION OF THE RULES OF SYNTAX.

Him and I went for a walk.

Him is the objective case of *he*, but is used as the subject of the verb *went* in this sentence, and consequently it should be *he*, in the nominative case, according to Rule 1.

John and *me* bought the house.

Me is the objective case of *I*. In this sentence it is used as the subject of the verb *bought*, and, according to rule, should be in the nominative case.

Him hesitating to come, I was indignant.

Him being used absolutely is, according to the rule, in the nominative case, and must therefore be *he*.

It was *them*.

Them, being predicated of the nominative *it*, should, according to the rule, be in the same case, and hence must be *they*.

Whom do you think it is?

It is nominative to the verb *is*, and *whom* being predicated of it, should be *who* to agree with it in case, according to Rule 3.

A six *days* walk.

Days, limiting the meaning of *walk* by denoting possession, must be in the possessive case, *days'*. (See Rule 4.)

Let *thou* and *I* the battle try.

Thou and *I* should be *you* and *me* to be in the objective case governed by the transitive verb *let*. Let *you* and *me* try the battle. (See Rule 5.)

Who have you found?

Who should be *whom*, as the objective of the transitive verb *found*. You have found *whom?*

The quarrel was between you and *I*.

The preposition *between* governs the pronouns *you* and *I* in the objective case. *I* is nominative, and should be *me* to be in the objective case. (See Rule 15.)

I arrived (*on*) Friday. Give (*to*) me the book.

In cases where a noun or pronoun limits the meaning of a verb or adjective, it is sometimes used in the objective case without the preposition expressed, as in above examples.

I do not know which one of the men commenced *their* work first.

Say, *his* work first, as, according to the rule, the pronoun must agree with its antecedent in gender, number, and person.

The hen takes care of *its* brood.

Its should be *her*, to agree in gender with its antecedent *hen*.

I had four *ton* of oats.

Ton should be *tons*. The adjective *four* must agree in number with the substantive to which it relates.

This ten years have I been unwell.

This should be *these*, to agree in number with years. (See Rule 9.)

Neither John nor you *was* there.

John and *you* differ in person, and are connected by the conjunction *nor*. The verb prefers the nominative next to it; hence *was* should be *were*.

A committee *were* appointed to audit the accounts.

Committee is a singular collective noun, the number embraced in it being viewed as one body, and hence should take *was*, a singular verb.

Peace and happiness *is* in the family.

Here are two nouns denoting different things connected by *and*, and they require a plural verb. *Is* should be *are*.

The mechanism of clocks and watches *were* then totally unknown.

It is not the *clocks* and *watches* that were unknown, but the *mechanism*, and hence the singular verb *was* is required.

Hand me *them* papers.

The pronoun *them* is here improperly used for the adjective *those*.

Read *slow* and *distinct*.

Adjectives qualify nouns, and adverbs modify verbs, adjectives, and other adverbs; *slow* and *distinct* should be *slowly* and *distinctly*, to modify the verb *read*.

Which is *best*, — apples or peaches?

Two objects only being compared, the comparative form *better* should be used.

Which is *nearer*, — New York, Baltimore, or Boston?

The superlative *nearest* should be used when three or more are compared.

It is the *awkwardest* job I ever saw him do.

Most awkward should be used, as some adjectives of two, and all adjectives of more than two, syllables are compared by the use of *more* and *most*. (See rule under adjectives.)

It is *an* useful book.

In the word *useful u* has a consonant sound, and requires the indefinite article *a* before it.

A honest man he was.

A is used before consonant sounds. *H* in "honest" has the sound of a vowel and requires *an*.

A rose is a beautiful flower.

The indefinite articles denote one of several indefinitely, while *the* denotes the class, or the only one; hence *the* should be used for *a* in the above sentence, either to denote a *class*, or a *particular flower*.

This is Johns book.

Johns, being in the possessive case, should be written with an apostrophe; thus, John's.

The apples are *our's*.

A pronoun in the possessive case should never have an apostrophe; hence *ours* should be written without it.

Beaumont's and Fletcher's poetry was popular.

Where common possession is implied by a series of nouns, the sign of the possessive is taken by the one at the end only; thus, *Beaumont and Fletcher's* poetry was popular.

The lady and the lap-dog *which* I saw in the carriage.

That is applicable to either person or things; *who* is applied to persons only; and *which* is applied to things and inferior animals. *That* must be substituted for *which* in the sentence quoted.

The heroic men *which* defended Thermopylæ.

Which should be *who*, to agree with its antecedent *man.*

The person who can write the oration, and *that* can also deliver it, should be chosen.

Who should be substituted for *that*, as it is improper in the same construction to mix different kinds of pronouns.

I was fearful lest I *would* lose my life.

Should expresses it better; as, *would* usually represents the act as something desired.

I *will* be drowned.

It is here signified that it is my determination to be drowned despite all efforts that may be made to save me. I *shall* simply foretells.

I never *done* it.

The past tense *did*, without an auxiliary, should here be used to predicate a past act.

John has *wrote* an essay.

Wrote should be *written.*

The perfect participle should be used after the verb *have* and its variations.

The branches were *broke* by the wind.

Broke should be *broken.*

After the verb *be*, and its variations, the perfect participle should be used.

If I *was* you, I would take the situation.

The above sentence should be in the subjunctive form, *if I were you*, to denote present or indefinite time, and not past or future, and to make the tense move forward in time.

Is not that pretty? I should say it *was.*

The thing spoken of being a present fact, it must be expressed in the present tense. *Is* should, therefore, be substituted for *was.*

I wished to have gone to them.

As the perfect infinitive *to have gone* does not imply antecedent time, but denotes something as past at the time referred to, the present infinitive *to go* should be used.

I hoped *to have met* some of my comrades there.

This sentence should read: I hoped *to meet*, etc.

The house is being built.

The compound participle in the above sentence is needless, and its use should be avoided. The house *is building*, is the correct mode of expression.

Prohibition is now *being* enforced.

Being should be omitted.

WORDS IMPROPERLY ARRANGED.

A sentence should be so arranged in all its parts as to make the meaning clear and the statement concise. Anything that tends to pervert or obscure the meaning should be left out, though in poetry considerable latitude in the arrangement of words is allowed.

Not only he found her handsome, but intelligent and refined also. This sentence is more clearly, correctly, and elegantly written thus: —

He found her not only handsome, but also intelligent and refined.

I and Robinson addressed the house. Etiquette requires that a person should speak of himself last.

There is a ripe dish of strawberries. The adjective *ripe* should be placed next *strawberries*, as the bad position of adjuncts and adjectives is usually improved when they are brought closer to the words they qualify.

I shall be happy always to meet them. Adverbs are generally placed between the auxiliary and the rest of the verb when it is compound in form. The above sentence should read, I shall always be happy, etc.

If a part of a sentence refers to each of two or more parts, it should be applicable to each.

He is taller, but not so muscular, than his brother. Better written, He is taller than his brother, but not so muscular.

REMARKS.

As a rule, the fewer words we use to express our meaning the better. Tautology, or the repetition of the same thing in different ways, should be avoided. No words should be used that do not add to the clearness and force of the sentence, and all should be omitted that would tend either to obscure the meaning or render it ambiguous.

There are some expressions in which *to*, the sign of the infinitive, should be used after the verbs *see*, *make*, *feel*, *bid*, *dare*, etc.; as, I dared him to fight; my crops bid fair to harvest well; I cannot see to sign my name.

In the sentence, I feel bad or badly, custom favors *badly* and analogy favors *bad*.

The pronoun *it* is sometimes applied to small children, as well as to inferior animals.

Some writers use *as follow* when it is preceded by a plural noun; but the majority favor *as follows*, whether preceded by a singular or plural noun.

When a noun is preceded by a numeral and cardinal adjective, the numeral is usually placed first; as, *the first two soldiers*, instead of *the two first soldiers*, as there cannot be two first.

FIGURES OF SPEECH.

A **figure**, in the science of language, is a departure from the ordinary form of words, from the rules of syntax, or from the use of words in their literal meaning. By the use of figures the beauty, force, and clearness of language may be greatly enhanced.

Figures of speech are divided into *figures of orthography and etymology*, *figures of syntax*, and *figures of rhetoric*.

FIGURES OF ORTHOGRAPHY AND ETYMOLOGY.

The principal figures of orthography and etymology are as follows: —

Aphæresis is the omitting of a letter or syllable at the beginning of a word; as *'neath* for *beneath*.

Syncope is the omission of a letter or syllable from the middle of a word; as, *thund'ring* for *thundering*.

Apocope is the omission of a letter or syllable from the end of a word; as *fro'* for *from*, *tho'* for *though*.

Prosthesis is the lengthening of a word by prefixing a syllable; as, *beloved* for *loved*.

Paragoge is the lengthening of a word by the addition of a syllable; as, *Johnny* for *John*.

The omission of letters from any part of a word is called *Elision*.

The omission of words is called *Ellipsis*.

Diæresis is the resolution of a diphthong, or of a contracted syllable, into two syllables, and is denoted by the mark (¨), as in aërial.

Synæresis is the union of two syllables into one in pronunciation; as, *Is'-rael* for *Is'-ra-el*.

Tmesis is the separation of the parts of a compound word; as, "The Lord is long-suffering *to* us-ward."

FIGURES OF SYNTAX.

The principal figures of syntax are as follows: —

Ellipsis, or the omission of a word or words not essential to the meaning, but necessary to the grammatical construction; as, the boy I met in the lane, for the boy *whom* I met in the lane.

Pleonasm is the use of unnecessary or superfluous words; as, "Her hands, they were whiter than snow."

Enallage is the use of one form of a word or of one part of speech for another; as, "Their furrow oft the stubborn glebe hath *broke*"; the fearful hare limps *awkward*.

Hyperbaton or **inversion** is the transposition of words; as, "A man he was to all the country dear."

FIGURES OF RHETORIC.

Rhetorical figures are the most important of the figures of speech; and commonly the term "figures of speech' is employed to denote only these. The following are the principal rhetorical figures: —

A **simile** is a comparison generally expressed by *like* or *as;* as, "Then, *like a passing thought*, she fled in dreams away."

A **metaphor** is an implied comparison. Instead of saying, as in a simile, one thing is *like* another, it says one thing *is* another; as, "Time is *the warp of life*"; I am a *rock;* thou art *the fortress.*

An **allegory** is a story so told that another meaning than that expressed in words is understood. It is metaphor continued, and differs from a tale in being written expressly for the sake of the underlying meaning. Bunyan's "Pilgrim's Progress" is perhaps as good an example as there is.

A *parable* is an allegory, but the word is generally used to denominate those allegorical tales in Scripture which were introduced for the purpose of illustrating some truth to which they have a similitude; such as that of "The Prodigal Son," "The Sower," and "The Ten Virgins."

Metonymy is a figure of speech by which the cause is put for the effect, and the effect for the cause; the container for the thing contained; and the sign for the thing signified; as, the kettle boils; they drank many cups; he assumed the sceptre.

Synecdoche consists in putting the whole for a part, or a part for the whole; the singular for the plural, or the plural for the singular; as, can you stay for *tea?* (meaning supper); stay thy avenging *steel!* (meaning sword.)

Personification represents inanimate objects as having life or action; as, "Time is a pilgrim old and gray."

This figure often constitutes the very life of poetry.

Antithesis consists in causing objects or qualities which are opposed to each other to appear by contrast in a stronger light, and the beauties or defects of each to stand in bolder relief; as, he is *mighty*, yet *tender.*

Antitheses are much employed in argument, and in descriptions of characters in history.

Irony consists in so employing words that the meaning conveyed shall be precisely the opposite of that which is stated; as when we call a scolding woman a *lamb*, or a fool a *Solomon:* "Brutus is an *honorable* man."

Irony is generally employed for the purpose of ridicule; and, when bitter or cutting, it is called sarcasm; as, brilliant scholar! (to a blockhead.)

Paralipsis is the pretended omission or concealment of what is really expressed; as, I will not speak of his depraved nature, of his low habits, nor of his lower companions.

Hyperbole consists in exaggeration. It makes use of strong and extravagant expressions not designed to be taken literally; as, "They cheered until the old house shook."

This figure must be employed with great care, as it easily degenerates into bombast.

Climax consists of a gradual rise in thought from small things or circumstances to those of more importance; as, he ascended slopes, hills, mountains; the Delphian vales, the Palestines, the Meccas of the mind.

Anticlimax is the reverse of climax, and consists in a gradual descent from important to trival things or circumstances; as, —

"And thou, Dalhousie, great god of war,
Lieutenant-colonel to the Earl of Mar."

"As the lark's shrill song to heaven ascends,
Yet grovelling on the earth the carol ends."

Allusion consists in recalling incidentally, by the use of a word or words in a sentence, some similar incident or subject; as, I was surrounded by difficulties, and possessed no *clew* by which I could effect my escape.

A **parody** is a continued allusion; as, —

"'T is the last rose of summer, left blooming alone;
All her lovely companions are faded and gone."

Parody: —

> "'T is the last golden dollar left shining alone;
> All its brilliant companions are squandered and gone."

Euphemism consists in softening a disagreeable fact or statement by means of circumlocution; as, he is destitute of neatness, for he is a dirty fellow.

Interrogation is a mode of strengthening an affirmation by putting in the form of a question that which you would affirm or deny most positively; as, will, then, the American people submit? will they sit quietly down?

> "Breathes there a man with soul so dead
> Who never to himself hath said,
> This is my own, my native land?"

Exclamation is that figure of speech by which the emotions of the writer or speaker are more strongly expressed; as, "O Liberty, what crimes are committed in thy name!" "O Time, Time! it is fit thou shouldst thus strike thy murderer to the heart! How art thou fled forever! A month! Oh for a single week! I ask not for years, though an age were too little for the much I have to do!"

Apostrophe is a sudden turning away to address some object real or imaginary; as, "O Death, the poor man's surest friend!"

> "O thou Parnassus, whom I now survey,
> Not in the frenzy of a dreamer's eye;
> Not in the fabled landscape of a lay,
> But soaring, snow-clad, through thy native sky."

Vision consists in presenting the objects or events of the past or future as if they were actually present; as, "We behold houses and public edifices wrapt in flames; we hear the crash of roofs falling in, and one general uproar proceeding from a thousand different voices."

> "Thy blood is cold; thou hast no speculation
> In those eyes which thou dost stare with.
> Hence, horrible shadow! unreal mockery, hence!"

Onomatopœia consists in the use of words which will, by their sound, suggest their meaning; as, buzz, hiss, crash, etc.

PUNCTUATION.

Punctuation treats of the marks used in writing and printing, and is used principally for marking the grammatical divisions of a sentence.

The principal marks of this kind are, — comma, semicolon, colon, period, exclamation-point, interrogation-point, and dash.

THE COMMA.

The comma is used, —

1. To separate two or more words closely related, between which the connecting word is omitted; as, he was a brave, honest, upright man.
2. Before a relative clause, where it is explanatory of the antecedent; also to set off any part of a sentence which contains the case absolute, the nominative independent, or any parenthetical clause; also simple members of sentences connected by words expressing comparison: as, night having come on, the enemy withdrew; knowledge and wisdom, far from being one, have ofttimes no connection; he will then, *however*, do as I have instructed.
3. To separate terms that are contrasted or in opposition; as, though strong, he was not rough.
4. To separate a noun or phrase when put in apposition; as, Homer, the Greek poet, is said to have been blind.
5. To separate the predicate from the subject, when the subject is so long, or has a clause so long, that the meaning would not be obvious; as, he who thinks so little of himself as to do that, will have few admirers.
6. To separate the following words and phrases from the remainder of the sentence: *nay, so, hence, however, besides, namely, perhaps, in short, at least, finally, moreover, again, first, secondly, thirdly, lastly, once more, on the contrary.*

7. To separate a person or an object addressed from the rest of the sentence; as, John, bring the horse from the stable.

8. To separate numbers into periods; as, area in square miles, 126,480.

9. To supply the place of an omitted word; as, cruelty begets hate; kindness, love.

THE SEMICOLON.

The **semicolon** is used, —

1. To separate the members of a sentence which are distinct propositions having a dependence upon each other, or upon some common clause; as, prosperity is naturally, though not necessarily, attached to virtue and merit; adversity, to vice and folly. Honesty is a jewel; it is above price.

2. To separate parts that have the comma, or that require a point greater than the comma; as, he was respectful, not servile, to superiors; affable, not improperly familiar, to equals; and condescending, not supercilious, to those beneath him.

3. To separate short sentences following one another, and slightly connected in sense or in construction; as, the old men sit at their doors; the gossip leans over her counter; the children shout and frolic in the streets.

4. To separate *as, viz., namely, to wit, i. e.*, or *that is*, from an example which they precede, or list of subjects which they enumerate; as, to Campbell we are indebted for the best didactic poem in the language; namely, "The Pleasures of Hope."

THE COLON.

The **colon** is used, —

1. To separate parts less connected than those which are divided by a semicolon, but which do not form distinct, independent sentences; as, the evil that men do lives after them: the good is oft interred with their bones.

2. To separate a clause that is complete in itself, but which is followed, without a conjunction, by some remark or illustration; as, do not spurn a poor man: his misery entitles him to pity.

3. Before a quotation or speech, or an enumeration of articles, when introduced formally; as, the concluding words of the "Siege of Warsaw," by Campbell, are beautiful: —

"Hope, for a season, bade the world farewell,
And Freedom shrieked as Kosciusko fell."

4. After a formal statement that ends with *as follows, thus, the following*, or other words of the same import.

THE PERIOD.

The **period** is used, —

1. To separate every complete sentence which is independent, also initial letters standing alone, and abbreviations; as, virtue is its own reward; William M. Evarts, Esq., addressed the meeting; C. O. D., for "collect on delivery."

2. To separate whole numbers from decimals, as 61.5, and after the enumeration of letters or figures; as, the earth has two motions, — 1. The diurnal motion; 2. The annual motion.

THE INTERROGATION-POINT.

The **interrogation-point** is used, —

After every sentence or part of a sentence which contains a question; as, who is the man? "will you surrender," said he, "or will you die?"

THE EXCLAMATION-POINT.

The **exclamation-point** is used, —

After a word, phrase, or sentence that denotes some sudden or violent emotion of the mind; as, Ah me, how long you are absent! "Alas poor Yorick! I knew him, Horatio."

THE DASH.

The **dash** is used, —

1. To show some sudden stop or change of subject, and to show the omission of words, letters, or figures; as, he sometimes counsel takes, and sometimes — snuff; men will wrangle for religion, write for it, fight for it, anything but — live for it.

2. Before *echoes;* that is, before a word or phrase repeated in an emphatic manner; as, they were impelled by the purest motives, — patriotism and liberty.

CURVES OR MARKS OF PARENTHESIS.

Curves are used, —

To enclose some incidental or explanatory remark that breaks the regular construction of the sentence, but which can be omitted without injuring the grammatical sense; as, —

> "He gave the world ('t was all he had) a tear.
> He gained from Heaven ('t was all he wished) a friend."

Brackets are used chiefly to give an explanation, to rectify a mistake, or to supply an omission; as, yours [the United States] is a nation of vast resources; do you know if [whether] he will go?

The **hyphen** is used to connect the parts of a compound word; as, land-league. It is also used at the end of a syllable when the remainder of the word follows on the next line, and also to divide a word into syllables; as, co-op-er-ate.

Quotation-marks are used to show that the words of an author or speaker are quoted, and consist of two inverted commas at the beginning and two apostrophes at the end of a quotation; as, "Know thyself" was inscribed upon the oracle at Delphi.

The **caret** (^) is used in manuscript to denote that something has been accidentally omitted, and the omitted matter is placed above; as, I am $\overset{\text{going}}{\wedge}$ to Boston.

UNDERSCORE.

The **underscore** is a line or lines drawn under words in writing that are to be printed in italics or capitals.

One line is drawn to have the letters *italic,* two lines for SMALL CAPITALS, and three lines for LARGE CAPITALS.

Words are generally placed in *italics* when they are meant to be emphatic; also, foreign words are usually *italicized.*

VERSIFICATION.

Poetry is the measured expression of feeling, thought, and creations of the imagination, ornamented and embellished, with the object of affording intellectual pleasure. Its primary object is to excite the passions; and its duty, to inculcate principles of morality and virtue. True poetry cannot be made the vehicle for a learned disquisition on any theme, inasmuch as its leading charm consists in its simplicity; and the nearer a poetical composition holds the "mirror up to Nature" the higher it ranks as a poetical effusion.

The handmaid of Poetry is Music; and the spirit of the latter, struggling for utterance in the mind of the poet, causes him to select euphonious words, and thus to make the language metrical. Dr. Johnson says, "Metaphysical poets are men of learning, who wish to show their learning in their rhyme; but, as they copy neither nature nor life, they are incapable of moving the affections." A person may be a true poet though comparatively unlettered, — a fact of which our literature affords many illustrations.

The tendency to use metrical language, in those gifted with poetic power, gives rise to *versification,* which is the art of making *verse.*

The essential requisite of verse is *rhythm,* which is the resultant of the action of the mind and voice in passing along the words with a sort of measured cadence.

Rhyme is the similarity of the sound of words at proportionate intervals.

In versification *rhythm* is necessary, but rhyme is not; though the artistic excellence of poetry is its rhythm and its rhyme.

> "You may break, you may shatter the vase, if you will,
> Yet the scent of the roses will hang round it still." — *Moore.*
>
> "And, as the lark's shrill song to heaven ascends,
> Yet grovelling on the earth the carol ends." — *Burns.*
>
> "'T is sweet to hear the watch-dog's honest bark
> Bay deep-mouthed welcome as we draw near home." — *Byron.*

The style of versification should accord with the sentiments intended to be expressed; and, when once adopted, should not be departed from throughout the same poem. In Oriental countries the opinion prevails that poems should be varied in versification in order to produce the greatest pleasure; and, in conformity with this idea, Byron wrote his "Don Juan," and Moore his "Lalla Rookh." Such promiscuous arrangement, however, should never be resorted to, except where the diversity renders the verse more harmonious and agreeable than the regular style would make it.

Songs, which are generally the embodiment of airs or tunes, are usually not so regular as other poems. The song-writer is invariably a combination of the poet and musical composer. Byron says he often tried to write a song like some of Moore's, but never could acquit himself to his satisfaction.

The liberty which poets often take with the language is considered admissible, and is termed *poetic license.* They are, as a rule, allowed any arrangement of words that will add harmony to their numbers without vitiating the sense.

A **simple foot** in versification is a portion of a line comprising at least two, but not more than three, syllables.

Feet are formed according to accent and quantity.

In English there are four principal feet; namely, the *iambus*, the *anapest*, the *trochee*, and the *dactyl:* and three secondary feet; namely, the *cæsura*, the *spondee*, and the *pyrrhic.*

The **iambus** consists of two syllables, a short and a long syllable, with the accent on the second; as,—

> "Thĕ cūr′fĕw tōlls′ thĕ knĕll′ ŏf pārt′ĭng dāy′,
> Thĕ lōw′ĭng hĕrd wĭnds slōw′ly̆ o’ĕr′ thĕ lēa′." —*Gray's "Elegy."*

In our poetical selections the following are in this measure: —

"Praise of Women," "Bridal Day," "Mercy," "What 's in a Name," "Secret Love," "The Winning of Juliet," "The Seven Ages of Man," "To Celia," "Elegy on Shakespeare," "The Invocation," "Advice to Poets," "Fame," "Procrastination," "Virtue," "Home," "To a Mountain Daisy," "A True Woman," "Genevieve," "The Exchange," "Genius of Byron," "Good-by, Proud World," "Love of Country," "The Ocean," "Hope," "Barbara Frietchie," "The Village Blacksmith," "Close of Autumn."

The **trochee** consists of a foot of two syllables, with the accent on the first; as, —

> "Sōl′dĭer, rēst′! thy̆ wār′fāre ō’′ĕr,
> Slēep′ thĕ slēep′ thăt knōws′ nŏt brēak′ĭng!" —*Scott.*

In our poetical selections the following are in this measure: —

"Bannockburn," "Lay of the Last Minstrel," "Domestic Peace," "Psalm of Life," "The Raven."

The **anapest** consists of a foot of three syllables with the accent on the last; as, —

> "I ăm mōn′ărch ŏf āll′ I sŭrvēy′;
> My̆ rīght′ thĕre ĭs nōne′ tŏ dĭspūte." — *Cowper.*

In our poetical selections, the following are in this measure: —

"Stanzas to Augusta," "The Last Rose of Summer," "The Meeting of the Waters," "The Boys."

The **dactyl** consists of a foot of three syllables, with the accent on the first; as, —

> "One′ mŏre ŭnfōr′tŭnăte,
> Wéary̆ ŏf brĕath." — *Hood.*

In our poetical selections the following are in this measure: —

"Hail to the Chief," "The Light Brigade."

The *iambus* and the *anapest,* being kindred feet, are sometimes used promiscuously; as,—

Fŏr thĕ wi′nds ănd thĕ wā′ves ăre āb′sĕnt thēre′,
And thĕ sā′nds ăre brī′ght ăs thĕ stārs′ thăt glōw′.

The *trochee* and the *dactyl,* being kindred feet, are sometimes used promiscuously; as,—

Bō′undĭng ăwāy′ ŏ′ĕr hī′ll ănd vă′llĕy.

A **cæsura** is a long or accented syllable used as one foot, and which divides the line, as it were, into two members; as,—

A green isle in the sea, *love*,
A fountain and a shrine.

A **spondee** consists of two long or accented syllables; as,—

Nēar′ thĕ lāke′ whĕre drōoped′ thĕ wīl′lŏw,
Lōng′ *tīme*′ ăgō.′

A **pyrrhic** consists of a foot of two syllables left unaccented; as,—

Of thĕ lōw′ sŭnsĕt clōuds′, *ănd thĕ* blūe′ skȳ′.

POETIC LINES.

Lines are divided, according to the number of feet which they contain, into the following:—

Monometer, a line of one foot; as,—

Rĕstraīn′.

Dimeter, a line of two feet; as,—

Thĕ ān′gĕl spōke′.

Trimeter, a line of three feet; as,—

Abōve′ thĕ moūn′taĭn hīgh′.

Tetrameter, a line of four feet; as,—

Thĕ bōy′ stoŏd ōn′ thĕ būrn′ĭng′ dĕck′.

Pentameter, a line of five feet; as,—

Sweĕt Aū′bŭrn! lōve′lĭĕst vĭl′lăge ōf′ thĕ plāin′.

Hexameter, a line of six feet; as,—

Whĕn thōu′ ărt nīgh′, ĭt seēms′ ă nēw′ crĕā′tiŏn rōund′.

Heptameter, a line of seven feet; as,—

Thĕ rōb′ĭn ānd′ thĕ wrēn′ hăve flōwn′, ănd frōm′ thĕ shrūb′ thĕ jāy′.

Octometer a line of eight feet; as,—

Beāms′ ŏf noōn′, lĭke būrn′ĭng lăn′cĕs, thrōugh′ thĕ treē′-tŏps flăsh′ ănd glĭs′tĕn.

Poetic pauses are introduced to improve the rhythm or verse. There are two pauses, the *final* and the *cæsural.*

The **final pause** is a slight pause made at the end of each line of poetry, not required by the grammatical sense; as,—

Let lords and ladies laugh and sing |
As loudly and as light.

The **cæsural pause** is a slight pause, generally made about the middle of long lines; as,—

Glows in the stars | and blossoms in the trees.

Verse without rhyme is called *blank verse.*

Heroic verse is composed of iambic pentameters.

An Alexandrine is usually an iambic hexameter.

A **couplet** is two poetic lines which usually rhyme together.

A **stanza** is composed of three or more poetic lines that generally make a regular division of a poem.

Gems of English Poetry.

For the measure of the various selections, see VERSIFICATION.
The figures following the name of each author represent the date of birth and death.

[GEOFFREY CHAUCER. 1328-1400.]

PRAISE OF WOMEN.

FOR, this ye know well, tho' I wouldin lie,
In women is all truth and steadfastness;
For, in good faith, I never of them sie
But much worship, bounty, and gentleness,
Right coming, fair, and full of meekéness;
Good, and glad, and lowly, I you ensure,
In this goodly and àngelic creatùre.

And if it hap a man be in disease,
She doth her busíness and her full pain
With all her might him to comfòrt and please,
If fro' his dìsease him she might restrain:
In word ne deed, I wis, she woll not faine;
With all her might she doth her busíness
To bringen him out of his heaviness.

Lo, here what gentleness these women have,
If we could know it for our rudéness!
How busy they be us to keep and save
Both in hele and also in sicknèss,
And alway right sorry for our distress!
In evéry manère thus shew they ruth,
That in them is all goodness and all truth.

[EDMUND SPENCER. 1553-1599.]

THE BRIDAL DAY.

OPEN the temple-gates unto my love,
Open them wide that she may enter in,
And all the posts adorn as doth behove,
And all the pillars deck with garlands trim,
For to receive this saint with honour due,
That cometh in to you.
With trembling steps and humble reverence
She cometh in before th' Almighty's view:
Of her, ye virgins! learn obedience,
When so ye come into these holy places,
To humble your proud faces.
Bring her up to th' high altar, that she may
The sacred ceremonies there partake,
The which do endless matrimony make;
And let the roaring organs loudly play
The praises of the Lord, in lively notes,
The whiles with hollow throats
The choristers the joyous anthems sing,
That all the woods may answer, and their echo ring.

Behold whiles she before the altar stands,
Hearing the holy priest that to her speaks,
And blesses her with his two happy hands,
How red the roses flush up in her cheeks!
And the pure snow, with goodly vermil stain,
Like crimson dy'd in grain,
That even the angels, which continually
About the sacred altar do remain,
Forget their service, and about her fly,
Oft peeping in her face, that seems more fair
The more they on it stare;
But her sad eyes, still fast'ned on the ground,
Are governed with goodly modesty,
That suffers not one look to glance awry,
Which may let in a little thought unsound.
Why blush ye, Love! to give me your hand,
The pledge of all your band?
Sing, ye sweet angels! Alleluia sing,
That all the woods may answer, and your echo ring.

Now all is done: bring home the bride again,
Bring home the triumph of our victory:
Bring home with you the glory of her gain,
With joyance bring her, and with jollity.
Never had men more joyful day than this,
Whom Heaven would heap with bliss.
Make feast, therefore, now all this livelong day,
This day forever to me holy is;
Pour out the wine without restraint or stay,
Pour not by cups, but by the belly-full:
Pour out to all that wull,
And sprinkle all the posts and walls with wine,
That they may sweat, and drunken be withal:
Crown ye god Bacchus with a coronal,
And Hymen also crown with wreaths of vine,
And let the Graces dance unto the rest,
For they can do it best,
The whiles the maidens do their carol sing,
To which the woods shall answer, and their echo ring.

Ring ye the bells, ye young men of the town,
And leave your wonted labours for this day;
This day is holy; do you write it down,
That ye forever it remember may.

. . . .

Now cease, ye damsels! your delights forepast,
Enough it is that all the day was yours;
Now day is done, and night is nighing fast,
Now bring the bride into the bridal bowers;
Now night is come, now soon her disarray,
And in her bed her lay;
Lay her in lilies and in violets,
And silken curtains over her display,
And odour'd sheets, and arras coverlets.
Behold how goodly my fair love does lie,
In proud humility;
Like unto Maia, when as Jove her took
In Tempe, lying on the flow'ry grass,
'Twixt sleep and wake, after she weary was
With bathing in the Acidalian brook:
Now it is night, ye damsels may be gone,
And leave my love alone,
And leave likewise your former lays to sing;
The woods no more shall answer, nor your echo ring.

[William Shakespeare. 1564-1616.]

THE WINNING OF JULIET.

Juliet. Thou know'st the mask of night is on my face:
Else would a maiden blush bepaint my cheek,
For that which thou hast heard me speak to-night.
Fain would I dwell on form, fain, fain deny
What I have spoke: but farewell compliment!
Dost thou love me? I know thou wilt say, Ay:
And I will take thy word; yet, if thou swear'st
Thou may'st prove false; at lover's perjuries,
They say Jove laughs. O gentle Romeo,
If thou dost love, pronounce it faithfully:
Or if thou think'st I am too quickly won,
I'll frown and be perverse, and say thee nay,
So thou wilt woo; but else not for the world.
In truth, fair Montague, I am too fond;
And therefore thou may'st think my 'havior light.
But trust me, gentleman, I'll prove more true
Than those that have more cunning to be strange.
I should have been more strange, I must confess,
But that thou overheard'st, ere I was 'ware,
My true love's passion: therefore pardon me;
And not impute this yielding to light love,
Which the dark night hath so discovered.

THE SEVEN AGES OF MAN.

All the world's a stage,
And all the men and women merely players:
They have their exits and their entrances;
And one man in his time plays many parts,
His acts being seven ages. At first, the infant,
Mewling and puking in the nurse's arms.
And then, the whining school-boy, with his satchel,
And shining morning face, creeping like snail
Unwillingly to school. And then, the lover,
Sighing like furnace, with a woful ballad
Made to his mistress' eyebrow. Then a soldier;
Full of strange oaths, and bearded like the pard,
Jealous in honor, sudden and quick in quarrel,
Seeking the bubble reputation
Even in the cannon's mouth. And then, the Justice,
In fair round belly, with good capon lined,
With eyes severe, and beard of formal cut,
Full of wise saws and modern instances;
And so he plays his part. The sixth age shifts
Into the lean and slipper'd Pantaloon,
With spectacles on nose, and pouch on side;
His youthful hose well saved, a world too wide
For his shrunk shank; and his big manly voice,
Turning again toward childish treble, pipes
And whistles in his sound. Last scene of all,
That ends this strange eventful history,
Is second childishness and mere oblivion,
Sans teeth, sans eyes, sans taste, sans everything.

As You Like It.

MERCY.

The quality of mercy is not strained;
It droppeth, as the gentle rain from heaven,
Upon the place beneath: it is twice blessed;
It blesseth him that gives, and him that takes:
'T is mightiest in the mightiest; it becomes
The thronèd monarch better than his crown;
His sceptre shows the force of temporal power,
The attribute to awe and majesty,
Wherein doth sit the dread and fear of kings;
But mercy is above this scepterèd sway,
It is enthroned in the hearts of kings,
It is an attribute to God himself;
And earthly power doth then show likest God's
When mercy seasons justice. Therefore, Jew,
Though justice be thy plea, consider this —
That, in the course of justice, none of us
Should see salvation. We do pray for mercy;
And that same prayer doth teach us all to render
The deeds of mercy.

Merchant of Venice.

WHAT 'S IN A NAME?

'Tis but thy name that is mine enemy;
Thou art thyself, though not a Montague.
What 's Montague? it is nor hand, nor foot,
Nor arm, nor face, nor any other part
Belonging to a man. Oh, be some other name!
What 's in a name? that which we call a rose
By any other name would smell as sweet;
So Romeo would, were he not Romeo called,
Retain that dear perfection which he owes,
Without that title: — Romeo, doff thy name;
And for that name, which is no part of thee,
Take all myself.

Romeo and Juliet.

SECRET LOVE.

She never told her love,
But let concealment, like a worm i' the bud,
Feed on her damask cheek: she pined in thought;
And, with a green and yellow melancholy,
She sat like Patience on a monument,
Smiling at Grief.

Twelfth Night.

[John Milton. 1608-1664]

THE INVOCATION AND INTRODUCTION.

Of man's first disobedience, and the fruit
Of that forbidden tree, whose mortal taste
Brought death into the world, and all our woe,
With loss of Eden, till one greater Man
Restore us, and regain the blissful seat,
Sing, heavenly Muse, that on the secret top
Of Oreb, or of Sinai, didst inspire
That shepherd, who first taught the chosen seed,
In the beginning, how the Heavens and Earth
Rose out of Chaos: or, if Sion hill
Delight thee more, and Siloa's brook that flowed
Fast by the oracle of God; I thence
Invoke thy aid to my adventurous song,
That with no middle flight intends to soar
Above the Aonian mount, while it pursues
Things unattempted yet in prose or rhyme.
And chiefly thou, O Spirit, that dost prefer
Before all temples the upright heart and pure,
Instruct me, for thou know'st; thou from the first
Wast present, and, with mighty wings outspread,
Dove-like sat'st brooding on the vast abyss
And mad'st it pregnant: what in me is dark
Illumine; what is low raise and support;
That to the height of this great argument
I may assert eternal Providence,
And justify the ways of God to man.
Say first, for Heaven hides nothing from thy view,
Nor the deep tract of Hell; say first, what cause
Moved our grand parents, in that happy state,
Favored of Heaven so highly, to fall off
From their Creator, and trangress his will
For one restraint, lords of the world besides?
Who first seduced them to that foul revolt?
The infernal serpent; he it was, whose guile,
Stirred up with envy and revenge, deceived
The mother of mankind, what time his pride
Had cast him out from Heaven, with all his host
Of rebel angels; by whose aid, aspiring
To set himself in glory above his peers,
He trusted to have equalled the Most High,
If he opposed; and, with ambitious aim
Against the throne and monarchy of God,
Raised impious war in Heaven, and battle proud,
With vain attempt. Him the Almighty power
Hurled headlong flaming from the ethereal sky,
With hideous ruin and combustion, down
To bottomless perdition; there to dwell
In adamantine chains and penal fire,
Who durst defy the Omnipotent to arms.

Paradise Lost.

[Ben Jonson. 1573-1637.]

TO CELIA.

I.

Drink to me only with thine eyes,
  And I will pledge with mine;
Or leave a kiss within the cup,
  And I 'll not look for wine.
The thirst that from the soul doth rise
  Doth ask a drink divine;
But might I of Jove's nectar sup,
  I would not change for thine.

II.

I sent thee late a rosy wreath,
  Not so much honoring thee
As giving it a hope that there
  It could not withered be;
But thou thereon didst only breathe,
  And sent'st it back to me,
Since when it grows, and smells, I swear,
  Not of itself, but thee.

ELEGY ON SHAKESPEARE.

To draw no envy, Shakespeare, on thy name,
Am I thus ample to thy book and fame:
While I confess thy writings to be such
As neither man nor muse can praise too much.

. . . . .

Soul of the age!
Th' applause! delight! the wonder of our stage!
My Shakespeare rise! I will not lodge thee by
Chaucer, or Spenser, or bid Beaumont lie
A little further, to make thee a room:
Thou art a monument without a tomb,
And art alive still, while thy book doth live,
And we have wits to read, and praise to give.
That I not mix thee so, my brain excuses,
I mean with great, but disproportioned muses:
For if I thought my judgment were of years,
I should commit thee surely with thy peers,
And tell how far thou didst our Lily outshine,
Or sportive Kyd, or Marlowe's mighty line.
And though thou hadst small Latin and less Greek,
From thence to honor thee, I will not seek
For names; but call forth thund'ring Eschylus,
Euripides, and Sophocles to us,
Pacuvius, Accius, him of Cordova dead,
To live again, to hear thy buskin tread,
And shake a stage; or when thy socks were on,
Leave thee alone for the comparison
Of all that insolent Greece or haughty Rome
Sent forth, or since did from their ashes come.
Triumph, my Britain! thou hast one to show
To whom all scenes of Europe homage owe.
He was not of an age, but for all time!
And all the muses still were in their prime,
When, like Apollo, he came forth to warm
Our ears, or like a Mercury to charm!
Nature herself was proud of his designs,
And joyed to wear the dressing of his lines!

. . . . .

Sweet swan of Avon! what a sight it were
To see thee in our water yet appear,
And make those flights upon the banks of Thames,
That so did take Eliza and our James!
But stay, I see thee in the hemisphere
Advanced, and make a constellation there!
Shine forth, thou star of poets, and with rage
Or influence chide or cheer the drooping stage,
Which, since thy flight from hence, hath mourned like night,
And despairs day but for thy volumes' light.

[John Dryden. 1631-1700.]

ADVICE TO POETS.

Observe the language well in all you write,
And swerve not from it in your loftiest flight.
The smoothest verse and the exactest sense
Displease us, if ill English give offence;
A barbarous phrase no reader can approve;
Nor bombast, noise, or affectation love.
In short, without pure language, what you write
Can never yield us profit nor delight.
Take time for thinking; never work in haste;
And value not yourself for writing fast.
A rapid poem, with such fury writ,
Shows want of judgment, not abounding wit.
More pleased we are to see a river lead
His gentle streams along a flowery mead,
Than from high banks to hear loud torrents roar,
With foamy waters on a muddy shore.
Gently make haste, of labor not afraid:
A hundred times consider what you 've said:
Polish, repolish, every color lay,
And sometimes add, but oftener take away.
'T is not enough, when swarming faults are writ,
That here and there are scattered sparks of wit;
Each object must be fixed in the due place,
And differing parts have corresponding grace:
Till, by a curious art disposed, we find
One perfect whole, of all the pieces joined.
Keep to your subject close in all you say;
Nor for a sounding sentence ever stray.
The public censure for your writings fear,
And to yourself be critic most severe.
Fantastic wits their darling follies love;
But find you faithful friends that will approve,
That on your works may look with careful eyes,
And of your faults be zealous enemies:
Lay by an author's pride and vanity,
And from a friend a flatterer descry,
Who seems to like, but means not what he says:
Embrace true counsel, but suspect false praise.
A sycophant will everything admire:
Each verse, each sentence, sets his soul on fire:
All is divine! there 's not a word amiss!
He shakes with joy, and weeps with tenderness,
He overpowers you with his mighty praise.
Truth never moves in those impetuous ways:
A faithful friend is careful of your fame,
And freely will your heedless errors blame;
He cannot pardon a neglected line,
But verse to rule and order will confine.
Reprove of words the too affected sound;
Here the sense flags, and your expression 's round,
Your fancy tires, and your discourse grows vain,
Your terms improper, make them just and plain.
Thus 't is a faithful friend will freedom use;
But authors, partial to their darling muse,
Think to protect it they have just pretence,
And at your friendly counsel take offence
Said you of this, that the expression 's flat?
Your servant, sir, you must excuse me that,

He answers you. This word has here no grace,
Pray leave it out: That, sir, 's the properest place.
This turn I like not: 'T is approved by all.
Thus, resolute not from one fault to fall,
If there 's a syllable of which you doubt,
'T is a sure reason not to blot it out;
Yet still he says you may his faults confute,
And over him your power is absolute:
But of his feigned humility take heed;
'Tis a bait laid to make you hear him read.
And when he leaves you happy in his muse,
Restless he runs some other to abuse,
And often finds; for in our scribbling times
No fool can want a sot to praise his rhymes:
The flattest work has ever in the court
Met with some zealous ass for its support:
And in all times a forward scribbling fop
Has found some greater fool to cry him up.

[Alexander Pope. 1688-1744.]

FAME.

What 's fame? a fancied life in others' breath,
A thing beyond us, even before our death.
Just what you hear, you have; and what 's unknown,
The same (my lord) if Tully's, or your own.
All that we feel of it begins and ends
In the small circle of our foes or friends;
To all beside as much an empty shade,
An Eugene living as a Cæsar dead;
Alike or when, or where, they shone, or shine,
Or on the Rubicon, or on the Rhine.
A wit 's a feather, and a chief 's a rod;
An honest man 's the noblest work of God.
Fame but from death a villain's name can save,
As justice tears his body from the grave;
When what t' oblivion better were resign'd,
Is hung on high to poison half mankind.
All fame is foreign, but of true desert;
Plays round the head, but comes not to the heart:
One self-approving hour whole years outweighs
Of stupid starers, and of loud huzzas;
And more true joy Marcellus exiled feels
Than Cæsar with a senate at his heels.

VIRTUE.

Know thou this truth, enough for man to know,
"Virtue alone is happiness below?"
The only point where human bliss stands still,
And tastes the good without the fall to ill;
Where only Merit constant pay receives,
Is blest in what it takes, and what it gives;
The joy unequalled if its end it gain,
And if it lose attended with no pain;
Without satiety, though e'er so blessed,
And but more relished as the more distressed;
The broadest mirth unfeeling Folly wears
Less pleasing far than Virtue's very tears:
Good, from each object, from each place acquired,
Forever exercised, yet never tired;
Never elated while one man 's oppressed;
Never dejected while another 's blessed:
And where no wants, no wishes can remain,
Since but to wish more virtue is to gain,
See the sole bliss Heaven could on all bestow!
Which who but feels can taste, but thinks can know;
Yet poor with fortune, and with learning blind,
The bad must miss; the good, untaught, will find:
Slave to no sect, who takes no private road,
But looks through Nature up to Nature's God;
Pursues that chain which links the immense design,
Joins heaven and earth, and mortal and divine;
Sees that no being any bliss can know,
But touches some above, and some below;
Learns, from this union of the rising whole,
The first, last purpose of the human soul;
And knows where Faith, Law, Morals, all began,
All end in Love of God, and Love of Man.

. . . . .

Grasp the whole worlds of Reason, Life, and Sense,
In one close system of Benevolence:
Happier as kinder, in whate'er degree,
And height of Bliss but height of Charity.

God loves from whole to parts: but human soul
Must rise from individual to the whole.
Self-love but serves the virtuous mind to wake,
As the small pebble stirs the peaceful lake;
The centre moved, a circle straight succeeds,
Another still, and still another spreads;
Friend, parent, neighbor, first it will embrace;
His country next, and next all human race;
Wide and more wide the o'erflowings of the mind
Take ev'ry creature in of ev'ry kind;
Earth smiles around, with boundless bounty blest,
And Heaven beholds its image in his breast.

Essay on Man.

[Edward Young. 1681-1765.]

SLEEP.

Tired Nature's sweet restorer, balmy Sleep!
He, like the world, his ready visit pays
Where Fortune smiles; the wretched he forsakes,
Swift on his downy pinions flies from woe,
And lights on lids unsullied by a tear.

PROCRASTINATION.

Be wise to-day: 't is madness to defer;
Next day the fatal precedent will plead;
Thus on, till wisdom is pushed out of life.
Procrastination is the thief of time;
Year after year it steals till all are fled,
And to the mercies of a moment leaves
The vast concerns of an eternal scene.
If not so frequent, would not this be strange?
That 't is so frequent, this is stranger still.

Of man's miraculous mistakes this bears
The palm, "That all men are about to live," —
Forever on the brink of being born.
All pay themselves the compliment to think
They one day shall not drivel: and their pride
On this reversion takes up ready praise;
At least, their own; their future selves applaud.
How excellent that life — they ne'er will lead!
Time lodged in their own hands is Folly's vails,
That lodged in Fate's to wisdom they consign;
The thing they can't but purpose, they postpone.
'T is not in folly, not to scorn a fool;
And scarce in human wisdom, to do more.
All promise is poor, dilatory man,
And that through every stage: when young, indeed,
If full content we sometimes nobly rest,
Unanxious for ourselves; and only wish,
As duteous sons, our fathers were more wise.
At thirty, man suspects himself a fool;
Knows it at forty, and reforms his plan;
At fifty chides his infamous delay,
Pushes his prudent purpose to resolve;
In all the magnanimity of thought
Resolves; and re-resolves; then, dies the same.

And why? Because he thinks himself immortal.
All men think all men mortal but themselves;
Themselves, when some alarming shock of fate
Strikes through their wounded hearts the sudden dread.
But their hearts wounded, like the wounded air,
Soon close, where, past the shaft, no trace is found.
As from the wing no scar the sky retains;
The parted wave, no furrow from the keel, —
So dies in human hearts the thought of death,
E'en with the tender tear which Nature sheds
O'er those we love, — we drop it in their grave.

[James Thompson. 1700–1748.]

THE CASTLE OF INDOLENCE.

In lowly dale, fast by a river's side,
With woody hill o'er hill encompassed round,
A most enchanting wizard did abide,
Than whom a fiend more fell is nowhere found:
It was, I ween, a lovely spot of ground:
And there a season atween June and May,
Half prankt with spring, with summer half imbrowned,
A listless climate made, where, sooth to say,
No living wight could work, ne cared even for play.

Was nought around but images of rest:
Sleep-soothing groves, and quiet lawns between;
And flowery beds that slumberous influence kest,
From poppies breathed; and beds of pleasant green,
Where never yet was creeping creature seen.
Meantime unnumbered glittering streamlets played
And purled everywhere their waters sheen;
That as they bickered through the sunny glade,
Though restless still themselves, a lulling murmur made.

Joined to the prattle of the purling rills,
Were heard the lowing herds along the vale,
And flocks loud-bleating from the distant hills;
And vacant shepherds piping in the dale:
And now and then sweet Philomel would wail,
Or stock-doves 'plain amid the forest deep,
That drowsy rustled to the sighing gale;
And still a coil the grasshopper did keep;
Yet all these sounds yblent inclined all to sleep.

Full in the passage of the vale above,
A sable, silent, solemn forest stood;
Where nought but shadowy forms were seen to move,
As Idless fancied in her dreaming mood:
And up the hills, on either side, a wood
Of blackening pines, ay waving to and fro,
Sent forth a sleepy horror through the blood;
And where this valley winded out, below,
The murmuring main was heard, and scarcely heard, to flow.

A pleasing land of drowsy-head it was,
Of dreams that wave before the half-shut eye;
And of gay castles in the clouds that pass,
Forever flushing round a summer sky:
There eke the soft delights, that witchingly
Instil a wanton sweetness through the breast,
And the calm pleasures always hovered nigh;
But whate'er smacked of 'noyance, or unrest,
Was far, far off expelled from this delicious nest.

[Thomas Gray. 1716–1771.]

ELEGY WRITTEN IN A COUNTRY CHURCHYARD.

The curfew tolls the knell of parting day,
The lowing herds wind slowly o'er the lea,
The ploughman homeward plods his weary way,
And leaves the world to darkness and to me.

Now fades the glimm'ring landscape on the sight,
And all the air a solemn stillness holds,
Save where the beetle wheels his droning flight,
And drowsy tinklings lull the distant folds.

. . . .

Beneath those rugged elms, that yew-tree's shade,
Where heaves the turf in many a mould'ring heap,
Each in his narrow cell forever laid,
The rude forefathers of the hamlet sleep.

The breezy call of incense-breathing Morn,
The swallow twitt'ring from the straw-built shed,
The cock's shrill clarion, or the echoing horn,
No more shall rouse them from their lowly bed.

For them no more the blazing hearth shall burn,
Or busy housewife ply her evening care;
No children run to lisp their sire's return,
Or climb his knees the envied kiss to share.

Oft did the harvest to their sickle yield,
Their furrow oft the stubborn glebe has broke:
How jocund did they drive their team afield!
How bowed the woods beneath their sturdy stroke!

Let not Ambition mock their useful toil,
Their homely joys, and destiny obscure;
Nor Grandeur hear with a disdainful smile
The short and simple annals of the poor.

. . . .

Nor you, ye proud, impute to these the fault,
If Mem'ry o'er their tombs no trophies raise,
Where, through the long-drawn aisle and fretted vault,
The pealing anthem swells the note of praise.

Can storied urn, or animated bust,
Back to its mansion call the fleeting breath?
Can Honor's voice provoke the silent dust,
Or Flatt'ry soothe the dull, cold ear of Death?

. . . .

But Knowledge to their eyes her ample page,
Rich with the spoils of time, did ne'er unroll;
Chill penury repressed their noble rage,
And froze the genial current of the soul.

Full many a gem of purest ray serene
The dark, unfathomed caves of ocean bear;
Full many a flow'r is born to blush unseen,
And waste its sweetness on the desert air.

Some village Hampden, that with dauntless breast
The little tyrant of his fields withstood;
Some mute, inglorious Milton here may rest,
Some Cromwell guiltless of his country's blood.

. . . .

Their names, their years, spelt by the unlettered Muse,
The place of fame and elegy supply;
And many a holy text around she strews,
That teach the rustic moralist to die.

[Oliver Goldsmith. 1725–1774.]

HOME.

As some lone miser, visiting his store,
Bends at his treasure, counts, recounts it o'er;
Hoards after hoards his rising raptures fill,
Yet still he sighs, for hoards are wanting still, —
Thus to my breast alternate passions rise,
Pleased with each good that Heaven to man supplies;
Yet oft a sigh prevails, and sorrows fall,
To see the hoard of human bliss so small;
And oft I wish, amidst the scene, to find
Some spot to real happiness consigned,
Where my worn soul, each wandering hope at rest,
May gather bliss to see my fellows blessed.

But where to find that happiest spot below,
Who can direct, when all pretend to know?
The shuddering tenant of the frigid zone
Boldly proclaims that happiest spot his own;
Extols the treasures of his stormy seas,
And his long nights of revelry and ease;
The naked negro, panting at the line,
Boasts of his golden sands and palmy wine,
Basks in the glare, or stems the tepid wave,
And thanks his gods for all the good they gave.
Such is the patriot's boast where'er we roam,
His first, best country ever is at home.
And yet, perhaps, if countries we compare,
And estimate the blessings which they share,
Though patriots flatter, still shall wisdom find
An equal portion dealt to all mankind:
As different good, by art or nature given,
To different nations makes their blessings even.

[William Cowper. 1731–1800.]

ALEXANDER SELKIRK.

I am monarch of all I survey,
My right there is none to dispute;
From the centre all round to the sea
I am lord of the fowl and the brute.
O Solitude, where are the charms
That sages have seen in thy face?
Better dwell in the midst of alarms
Than reign in this horrible place.

I am out of humanity's reach;
I must finish my journey alone;
Never hear the sweet music of speech —
I start at the sound of my own.
The beasts that roam over the plain
My form with indifference see;
They are so unacquainted with men,
Their tameness is shocking to me.

Society, friendship, and love,
Divinely bestowed upon man,
Oh, had I the wings of a dove,
How soon would I taste you again!
My sorrows I then might assuage
In the ways of religion and truth;
Might learn from the wisdom of age,
And be cheered by the sallies of youth.

Religion! what treasure untold
Resides in that heavenly word!
More precious than silver and gold,
Or all that this earth can afford.
But the sound of the church-going bell
These valleys and rocks never heard, —
Never sighed at the sound of a knell,.
Or smiled when a Sabbath appeared.

Ye winds that have made me your sport,
Convey to this desolate shore
Some cordial, endearing report,
Of a land I shall visit no more.
My friends, do they now and then send
A wish or a thought after me?
O tell me I yet have a friend,
Though a friend I am never to see.

How fleet is a glance of the mind!
Compared with the speed of its flight,
The tempest itself lags behind,
And the swift-wingèd arrows of light.
When I think of my own native land,
In a moment I seem to be there;
But, alas! recollection at hand
Soon hurries me back to despair.

But the sea-fowl is gone to her nest;
The beast is laid down in his lair;
Even here is a season of rest,
And I to my cabin repair.
There 's mercy in every place;
And mercy, encouraging thought!
Gives even affliction a grace,
And reconciles man to his lot.

[Robert Burns. 1759–1796.]

TO A MOUNTAIN DAISY,

ON TURNING ONE DOWN WITH THE PLOUGH IN APRIL, 1776.

Wee, modest, crimson-tippèd flow'r,
Thou's met me in an evil hour;
For I maun crush amang the stoure
Thy slender stem:
To spare thee now is past my pow'r,
Thou bonnie gem.

Alas! it 's no thy neebor sweet,
The bonnie Lark, companion meet!
Bending thee 'mang the dewy weet!
Wi' spreckl'd breast,
When upward-springing, blythe, to greet
The purpling east.

Cauld blew the bitter-biting north
Upon thy early, humble birth;
Yet cheerfully thou glinted forth
Amid the storm,
Scarce rear'd above the parent earth
Thy tender form.

The flaunting flow'rs our gardens yield,
High shelt'ring woods and wa's maun shield,
But thou, beneath the random bield*
O' clod or stane,
Adorns the histie † stibble-field,
Unseen, alane.

There, in thy scanty mantle clad,
Thy snawy bosom sunward spread,
Thou lifts thy unassuming head
In humble guise;
But now the share uptears thy bed,
And low thou lies!

Such is the fate of artless Maid,
Sweet flow'ret of the rural shade!
By love's simplicity betray'd,
And guileless trust,
Till she, like thee, all soil'd, is laid
Low i' the dust.

---

* Shelter. † Dry.

Such is the fate of simple Bard,
On life's rough ocean luckless starr'd!
Unskilful he to note the card
Of prudent lore,
Till billows rage, and gales blow hard,
And whelm him o'er!

Such fate to suffering worth is giv'n,
Who long with wants and woes has striv'n,
By human pride or cunning driv'n
To mis'ry's brink,
Till, wrench'd of ev'ry stay but Heav'n,
He, ruin'd, sink!

Ev'n thou who mourn'st the Daisy's fate,
That fate is thine — no distant date;
Stern Ruin's ploughshare drives, elate,
Full on thy bloom,
Till crushed beneath the furrow's weight,
Shall be thy doom.

BANNOCKBURN.

ROBERT BRUCE'S ADDRESS TO HIS ARMY.

Scots, wha hae wi' Wallace bled,
Scots, wham Bruce has aften led;
Welcome to your gory bed,
Or to victory!

Now 's the day, and now 's the hour;
See the front o' battle lower:
See approach proud Edward's pow'r —
Chains and slavery!

Wha will be a traitor knave?
Wha would fill a coward's grave?
Wha sae base as be a slave?
Let him turn and flee!

Wha for Scotland's King and law
Freedom's sword will strongly draw,
Freeman stand, or freeman fa',
Let him on wi' me!

By Oppression's woes and pains!
By your sons in servile chains!
We will drain our dearest veins,
But they shall be free!

Lay the proud usurpers low!
Tyrants fall in every foe!
Liberty 's in every blow!
Let us do, or die!

[William Wordsworth. 1770-1850.]

A TRUE WOMAN.

She was a phantom of delight
When first she gleamed upon my sight;
A lovely apparition, sent
To be a moment's ornament;
Her eyes as stars of twilight fair,
Like twilight's, too, her dusky hair;
But all things else about her drawn
From May-time and the cheerful dawn.
A dancing shape, an image gay,
To haunt, to startle, and waylay.

I saw her upon nearer view,
A spirit, yet a woman too!
Her household motions light and free,
And steps of virgin liberty;
A countenance in which did meet
Sweet records, promises as sweet;
A creature not too bright or good
For human nature's daily food,
For transient sorrows, simple wiles,
Praise, blame, love, kisses, tears, and smiles.

And now I see with eye serene
The very pulse of the machine;
A being breathing thoughtful breath,
A traveller betwixt life and death;
The reason firm, the temperate will,
Endurance, foresight, strength, and skill;
A perfect woman, nobly planned,
To warn, to comfort, and command;
And yet a spirit still, and bright
With something of an angel light.

[Sir Walter Scott. 1771-1832.]

THE LOVE OF COUNTRY.

Breathes there the man with soul so dead
Who never to himself hath said,
This is my own, my native land!
Whose heart hath ne'er within him burned
As home his footsteps he hath turned,
From wandering on a foreign strand?
If such there breathe, go, mark him well;
For him no minstrel raptures swell!
High though his titles, proud his name,
Boundless his wealth as wish can claim:
Despite those titles, power, and pelf,
The wretch, concentred all in self,
Living, shall forfeit fair renown,
And, doubly dying, shall go down
To the vile dust, from whence he sprung,
Unwept, unhonored, and unsung.

From the Lay of the Last Minstrel.

SOLDIER, REST!

Soldier, rest! thy warfare o'er,
Sleep the sleep that knows not breaking!
Dream of battled fields no more,
Days of danger, nights of waking.
In our isle's enchanted hall,
Hands unseen thy couch are strewing,
Fairy streams of music fall,
Every sense in slumber dewing.
Soldier, rest! thy warfare o'er,
Dream of fighting fields no more;
Sleep the sleep that knows not breaking,
Morn of toil, nor night of waking.

No rude sound shall reach thine ear,
Armor's clang, or war-steed champing,
Trump nor pibroch summon here
Mustering clan, or squadron tramping.
Yet the lark's shrill fife may come,
At the daybreak from the fallow,
And the bittern sound his drum,
Booming from the sedgy shallow;
Ruder sounds shall none be near,
Guards nor warders challenge here,
Here 's no war-steed's neigh and champing,
Shouting clans or squadrons stamping.

Huntsman, rest! thy chase is done,
While our slumbrous spells assail ye,
Dream not with the rising sun
Bugles here shall sound reveillé.
Sleep! the deer is in his den;
Sleep! thy hounds are by thee lying;
Sleep! nor dream in yonder glen
How thy gallant steed lay dying.
Huntsman, rest! thy chase is done,
Think not of the rising sun,
For, at dawning to assail ye,
Here no bugles sound reveillé.

Lady of the Lake.

HAIL TO THE CHIEF.*

Hail to the chief who in triumph advances!
Honored and blessed be the ever-green pine!
Long may the tree in his banner that glances
Flourish, the shelter and grace of our line!
Heaven send it happy dew,
Earth lend it sap anew;
Gayly to bourgeon, and broadly to grow,
While every Highland glen
Sends our shout back agen,
"Roderich Vich Alpine dhu, ho! ieroe!"

Lady of the Lake.

[Samuel Taylor Coleridge. 1772-1834.]

THE EXCHANGE.

We pledged our hearts, my love and I,—
I in my arms the maiden clasping;
I could not tell the reason why,
But, oh, I trembled like an aspen!

Her father's love she bade me gain;
I went, and shook like any reed!
I strove to act the man,—in vain!
We had exchanged our hearts indeed.

GENEVIEVE.

Maid of my love, sweet Genevieve!
In beauty's light you glide along;
Your eye is like the star of eve,
And sweet your voice as seraph's song.
Yet not your heavenly beauty gives
This heart with passion soft to glow;
Within your soul a voice there lives!
It bids you hear the tale of woe:
When sinking low, the sufferer wan
Beholds no hand outstretched to save,
Fair as the bosom of the swan
That rises graceful o'er the wave,
I 've seen your breast with pity heave,
And therefore love I you, sweet Genevieve!

DOMESTIC PEACE.

Tell me, on what holy ground
May Domestic Peace be found?
Halcyon Daughter of the skies,
Far on fearful wings she flies,
From the pomp of sceptred state,
From the rebel's noisy hate.
In a cottaged vale she dwells,
Listening to the Sabbath bells!
Still around her steps are seen
Spotless Honor's meeker mien,
Love, the sire of pleasing fears,
Sorrow smiling through her tears,
And, conscious of the past employ,
Memory, bosom-spring of joy.

---

* This song is intended as an imitation of the *jorrams*, or boat-songs of the Highlanders, which were usually composed in honor of a favorite chief. They are so adapted as to keep time with the sweep of the oars, and it is easy to distinguish between those intended to be sung to the oars of a galley, where the stroke is lengthened and doubled, as it were, and those which were timed to the rowers of an ordinary boat.

[Thomas Campbell. 1777-1844.]

HOPE.

Primeval Hope, the Aonian Muses say,
When Man and Nature mourned their first decay,
When every form of Death and every woe
Shot from malignant stars to Earth below,
When Murder bared her arm, and rampant War
Yoked the red dragons of her iron car;
When Peace and Mercy, banished from the plain,
Sprung on the viewless winds to heaven again, —
All, all forsook the friendless guilty mind,
But Hope, the charmer, lingered still behind.

Unfading Hope! when life's last embers burn
When soul to soul and dust to dust return,
Heaven to thy charge resigns the awful hour,
Oh, then thy kingdom comes! Immortal Power!
What though each spark of earth-born rapture fly
The quivering lip, pale cheek, and closing eye;
Bright to the soul thy seraph hands convey
The morning dream of life's eternal day, —
Then, then the triumph and the trance begin,
And all the phœnix spirit burns within!

Eternal Hope! when yonder spheres sublime
Pealed their first notes to sound the march of time,
Their joyous youth began — but not to fade
When all the sister planets have decayed;
When wrapt in fire the realms of ether glow,
And Heaven's last thunder shakes the world below, —
Thou, undismayed, shalt o'er the ruins smile,
And light thy torch at Nature's funeral pile!

[Thomas Moore. 1779-1852]

'T IS THE LAST ROSE OF SUMMER.

'T is the last rose of summer,
Left blooming alone;
All her lovely companions
Are faded and gone;
No flower of her kindred,
No rosebud is nigh,
To reflect back her blushes,
To give sigh for sigh.

I 'll not leave thee, thou lone one,
To pine on the stem;
Since the lovely are sleeping,
Go sleep thou with them.
Thus kindly I scatter
Thy leaves o'er the bed
Where thy mates of the garden
Lie scentless and dead.

So soon may I follow
When friendships decay,
And from Love's shining circle
The gems drop away!
When true hearts lie withered
And fond ones are flown,
Oh, who would inhabit
This bleak world alone?

THE MEETING OF THE WATERS.

There is not in the wide world a valley so sweet
As that vale in whose bosom the bright waters meet;
Oh, the last rays of feeling and life must depart
Ere the bloom of that valley shall fade from my heart.

Yet it was not that Nature had shed o'er the scene
Her purest of crystal and brightest of green;
'T was not her soft magic of streamlet or hill,
Oh, no! it was something more exquisite still.

'T was that friends, the beloved of my bosom, were near,
Who made every dear scene of enchantment more dear,
And who felt how the best charms of Nature improve,
When we see them reflected from looks that we love.

[Lord George Gordon Noel Byron. 1788-1824.]

THE OCEAN.

Roll on, thou deep and dark blue Ocean, roll!
Ten thousand fleets sweep over thee in vain;
Man marks the earth with ruin; his control
Stops with the shore: upon the watery plain
The wrecks are all thy deed, nor doth remain
A shadow of man's ravage, save his own,
When, for a moment, like a drop of rain,
He sinks into thy depths with bubbling groan,
Without a grave, unknelled, uncoffined, and unknown.

His steps are not upon thy paths; thy fields
Are not a spoil for him, — thou dost arise
And shake him from thee; the vile strength he wields
For earth's destruction thou dost all despise,
Spurning him from thy bosom to the skies,
And send'st him, shivering in thy playful spray
And howling, to his gods, where haply lies
His petty hope in some near port or bay,
And dashest him again to earth: there let him lay.

The armaments which thunderstrike the walls
Of rock-built cities, bidding nations quake,
And monarchs tremble in their capitals,
The oak leviathans, whose huge ribs make
Their clay creator the vain title take
Of lord of thee, and arbiter of war, —
These are thy toys, and, as the snowy flake,
They melt into thy yeast of waves, which mar
Alike the Armada's pride or spoils of Trafalgar.

Thy shores are empires, changed in all save thee;
Assyria, Greece, Rome, Carthage, what are they?
Thy waters washed them power while they were free,
And many a tyrant since; their shores obey
The stranger, slave, or savage; their decay
Has dried up realms to deserts: not so thou;
Unchangeable save to thy wild waves' play,
Time writes no wrinkle on thine azure brow;
Such as creation's dawn beheld, thou rollest now.

Thou glorious mirror, where the Almighty's form
Glasses itself in tempests; in all time,
Calm or convulsed, in breeze, or gale, or storm,
Icing the pole, or in the torrid clime
Dark-heaving, — boundless, endless, and sublime, —
The image of Eternity; the throne
Of the Invisible! even from out thy slime
The monsters of the deep are made: each zone
Obeys thee; thou goest forth, dread, fathomless, alone.

And I have loved thee, Ocean! and my joy
Of youthful sports was on thy breast to be
Borne, like thy bubbles, onward: from a boy
I wantoned with thy breakers; they to me
Were a delight; and if the freshening sea
Made them a terror, 't was a pleasing fear;
For I was, as it were, a child of thee,
And trusted to thy billows far and near,
And laid my hand upon thy mane — as I do here.

Childe Harold.

STANZAS TO AUGUSTA (LORD BYRON'S SISTER).

Though the day of my destiny 's over,
And the star of my fate hath declined,
Thy soft heart refused to discover
The faults which so many could find;
Though thy soul with my grief was acquainted,
It shrunk not to share it with me,
And the love which my spirit hath painted
It never hath found but in thee.

Then when nature around me is smiling,
The last smile which answers to mine,
I do not believe it beguiling,
Because it reminds me of thine;
And when winds are at war with the ocean,
As the breasts I believed in with me,
If their billows excite an emotion,
It is that they bear me from thee.

[Robert Pollock. 1790–1827.]

THE GENIUS OF BYRON.

He touched his harp, and nations heard, entranced.
As some vast river of unfailing source,
Rapid, exhaustless, deep, his numbers flowed,
And oped new fountains in the human heart.
Where Fancy halted, weary in her flight,
In other men, his, fresh as morning, rose,
And soared untrodden heights, and seemed at home,
Where angels bashful looked. Others, though great,
Beneath their arguments seemed struggling whiles;
He, from above descending, stooped to touch
The loftiest thought; and proudly stooped, as though
It scarce deserved his verse. With Nature's self
He seemed an old acquaintance, free to jest
At will with all her glorious majesty.
He laid his hand upon "the Ocean's mane,"
And played familiar with his hoary locks:
Stood on the Alps, stood on the Apennines,
And with the thunder talked as friend to friend;
And wove his garland of the lightning's wing,
In sportive twist, the lightning's fiery wing,
Which, as the footsteps of the dreadful God,
Marching upon the storm in vengeance, seemed;
Then turned, and with the grasshopper, who sung
His evening song beneath his feet, conversed.
Suns, moons, and stars, and clouds his sisters were;
Rocks, mountains, meteors, seas, and winds, and storms;
His brothers, younger brothers, whom he scarce
As equals deemed. All passions of all men,
The wild and tame, the gentle and severe;
All thoughts, all maxims, sacred and profane;
All creeds, all seasons, Time, Eternity;
All that was hated, and all that was dear;
All that was hoped, all that was feared, by man,
He tossed about, as tempest-withered leaves;
Then, smiling, looked upon the wreck he made.
With terror now he froze the cowering blood,
And now dissolved the heart in tenderness;

Yet would not tremble, would not weep himself;
But back into his soul retired, alone,
Dark, sullen, proud, gazing contemptuously
On hearts and passions prostrate at his feet.
So Ocean, from the plains his waves had late
To desolation swept, retired in pride,
Exulting in the glory of his might,
And seemed to mock the ruin he had wrought.
As some fierce comet of tremendous size,
To which the stars did reverence as it passed,
So he, through learning and through fancy, took
His flights sublime, and on the loftiest top
Of Fame's dread mountain sat; not soiled and worn,
As if he from the earth had labored up;
But, as some bird of heavenly plumage fair,
He looked, which down from higher regions came,
And perched it there, to see what lay beneath.

The Course of Time.

[THOMAS HOOD. 1798-1845.]

THE BRIDGE OF SIGHS.

ONE more unfortunate,
Weary of breath,
Rashly importunate,
Gone to her death!

Take her up tenderly,
Lift her with care;
Fashioned so slenderly,
Young, and so fair!

Look at her garments
Clinging like cerements;
Whilst the wave constantly
Drips from her clothing;
Take her up instantly,
Loving, not loathing!

Touch her not scornfully!
Think of her mournfully,
Gently and humanly;
Not of the stains of her;
All that remains of her
Now is pure womanly.

Make no deep scrutiny
Into her mutiny
Rash and undutiful;
Past all dishonor,
Death has left on her
Only the beautiful.

Still, for all slips of hers,
One of Eve's family,
Wipe those poor lips of hers
Oozing so clammily.

Loop up her tresses,
Escaped from the comb,
Her fair auburn tresses;
Whilst wonderment guesses
Where was her home?
Who was her father?
Who was her mother?
Had she a sister?
Had she a brother?
Or was there a dearer one
Still, or a nearer one
Yet, than all other?

Alas for the rarity
Of Christian charity
Under the sun!
Oh! it was pitiful,
Near a whole city full,
Home had she none!

Sisterly, brotherly,
Fatherly, motherly,
Feelings had changed;
Love, by harsh evidence
Thrown from its eminence,
Even God's providence
Seeming estranged.

Where the lamps quiver
So far in the river,
With many a light
From many a casement,
From garret to basement,
She stood, with amazement,
Houseless by night.

The bleak wind of March
Made her tremble and shiver;
But not the dark arch
Or the black flowing river.
Mad from life's history,
Glad to death's mystery,
Swift to be hurled
Anywhere! anywhere
Out of the world!

In she plunged boldly, —
No matter how coldly
The rough river ran, —
Over the brink of it!

Picture it — think of it,
  Dissolute man!
Lave in it — drink of it
  Then, if you can!

Take her up tenderly,
  Lift her with care!
Fashioned so slenderly,
  Young, and so fair!

Ere her limbs frigidly
Stiffen too rigidly,
  Decently, kindly,
Smooth and compose them;
And her eyes, close them,
  Staring so blindly!

Dreadfully staring
  Through muddy impurity,
As when with the daring,
Last look of despairing,
  Fixed on futurity.

Perishing gloomily,
Spurned by contumely,
  Cold inhumanity,
  Burning insanity,
Into her rest;
  Cross her hands humbly,
As if praying dumbly,
Over her breast!

Owning her weakness,
  Her evil behavior,
And leaving, with meekness,
  Her sins to her Saviour.

[Alfred Tennyson. 1810.]

THE CHARGE OF THE LIGHT BRIGADE AT BALAKLAVA.

I.

Half a league, half a league,
  Half a league onward,
All in the Valley of Death
  Rode the Six Hundred.
"Forward, the Light Brigade!
Charge for the guns!" he said:
Into the Valley of Death
  Rode the Six Hundred.

II.

"Forward, the Light Brigade!"
Was there a man dismayed?
Not though the soldier knew
  Some one had blundered:
Theirs not to make reply,
Theirs not to reason why,
Theirs but to do and die:
Into the Valley of Death
  Rode the Six Hundred.

III.

Cannon to right of them,
Cannon to left of them,
Cannon in front of them,
  Volleyed and thundered.
Stormed at with shot and shell,
Boldly they rode and well;
Into the jaws of Death,
Into the mouth of hell,
  Rode the Six Hundred.

IV.

Flashed all their sabres bare,
Flashed as they turned in air,
Sabring the gunners there,
Charging an army, while
  All the world wondered.
Plunged in the battery smoke,
Right through the line they broke:
Cossack and Russian
Reeled from the sabre-stroke,
  Shattered and sundered.
Then they rode back, but not,
  Not the Six Hundred.

V.

Cannon to right of them,
Cannon to left of them,
Cannon behind them,
  Volleyed and thundered.
Stormed at with shot and shell,
While horse and hero fell,
They that had fought so well
Came through the jaws of Death
Back from the mouth of hell,
All that was left of them,
  Left of Six Hundred.

VI.

When can their glory fade?
O the wild charge they made!
  All the world wondered.
Honor the charge they made!
Honor the Light Brigade,
  Noble Six Hundred.

[William Cullen Bryant. 1794–1878.]

THE CLOSE OF AUTUMN.

The melancholy days are come, the saddest of the year,
Of wailing winds and naked woods and meadows brown and sere.
Heaped in the hollows of the grove the withered leaves lie dead,
They rustle to the eddying gust and to the rabbit's tread.
The robin and the wren are flown, and from the shrubs the jay,
And from the wood-top calls the crow through all the gloomy day.

Where are the flowers, the fair young flowers, that lately sprung and stood,
In brighter light and softer airs, a beauteous sisterhood?
Alas! they all are in their graves, — the gentle race of flowers
Are lying in their lowly beds, with the fair and good of ours:
The rain is falling where they lie; but the cold November rain
Calls not from out the gloomy earth the lovely ones again.

The windflower and the violet, they perished long ago,
And the brier-rose and the orchis died, amid the summer's glow;
But on the hill the goldenrod, and the aster in the wood,
And the yellow sunflower by the brook, in autumn beauty stood,
Till fell the frost from the clear, cold heaven, as falls the plague on men,
And the brightness of their smile was gone from upland, glade, and glen.

And now, when comes the calm, mild day, as still such days will come,
To call the squirrel and the bee from out their winter home;
When the sound of dropping nuts is heard, though all the trees are still,
And twinkle in the smoky light the waters of the rill, —
The south-wind searches for the flowers whose fragrance late he bore,
And sighs to find them in the wood and by the stream no more.

And then I think of one who in her youthful beauty died, —
The fair, meek blossom that grew up and faded by my side.
In the cold, moist earth we laid her when the forest cast the leaf,
And we wept that one so lovely should have a lot so brief;
Yet not unmeet it was that one, like that young friend of ours,
So gentle and so beautiful, should perish with the flowers.

[Henry Wadsworth Longfellow. 1807–1882.]

A PSALM OF LIFE.

WHAT THE HEART OF THE YOUNG MAN SAID TO THE PSALMIST.

Tell me not, in mournful numbers,
"Life is but an empty dream!"
For the soul is dead that slumbers,
And things are not what they seem.

Life is real! Life is earnest!
And the grave is not its goal;
"Dust thou art, to dust returnest,"
Was not spoken of the soul.

Not enjoyment, and not sorrow,
Is our destined end or way;
But to act, that each to-morrow
Find us farther than to-day.

Art is long, and Time is fleeting,
And our hearts, though stout and brave,
Still, like muffled drums, are beating
Funeral marches to the grave.

In the world's broad field of battle,
In the bivouac of Life,
Be not like dumb, driven cattle!
Be a hero in the strife!

Trust no Future, howe'er pleasant!
Let the dead Past bury its dead!
Act, — act in the living Present!
Heart within, and God o'erhead.

Lives of great men all remind us
We can make our lives sublime,
And, departing, leave behind us
Footprints on the sands of time, —

Footprints that perhaps another,
  Sailing o'er life's solemn main,
A forlorn and shipwrecked brother,
  Seeing, shall take heart again.

Let us, then, be up and doing,
  With a heart for any fate;
Still achieving, still pursuing,
  Learn to labor and to wait.

THE VILLAGE BLACKSMITH.

Under a spreading chestnut-tree
  The village smithy stands;
The smith, a mighty man is he,
  With large and sinewy hands;
And the muscles of his brawny arms
  Are strong as iron bands.

His hair is crisp and black and long,
  His face is like the tan;
His brow is wet with honest sweat,
  He earns whate'er he can,
And looks the whole world in the face,
  For he owes not any man.

Week in, week out, from morn till night,
  You can hear his bellows blow;
You can hear him swing his heavy sledge,
  With measured beat and slow,
Like a sexton ringing the village bell,
  When the evening sun is low.

And children coming home from school
  Look in at the open door:
They love to see the flaming forge,
  And hear the bellows roar,
And catch the burning sparks that fly
  Like chaff from a threshing floor.

He goes on Sunday to the church,
  And sits among his boys;
He hears the parson pray and preach,
  He hears his daughter's voice
Singing in the village choir,
  And it makes his heart rejoice.

It sounds to him like her mother's voice,
  Singing in Paradise!
He needs must think of her once more,
  How in the grave she lies;
And with his hard, rough hand he wipes
  A tear out of his eyes.

Toiling, — rejoicing, — sorrowing,
  Onward through life he goes;
Each morning sees some task begun,
  Each evening sees it close;
Something attempted, something done
  Has earned a night's repose.

Thanks, thanks to thee, my worthy friend,
  For the lesson thou hast taught!
Thus at the flaming forge of life
  Our fortunes must be wrought!
Thus on its sounding anvil shaped
  Each burning deed and thought!

[John Greenleaf Whittier. 1807.]

BARBARA FRIETCHIE.

Up from the meadows, rich with corn,
Clear in the cool September morn,
The clustered spires of Frederick stand,
Green-walled by the hills of Maryland.

Round about them orchards sweep,
Apple and peach tree fruited deep;
Fair as a garden of the Lord
To the eyes of the famished rebel horde.

On that pleasant morn of the early fall,
When Lee marched over the mountain wall,
Over the mountains winding down,
Horse and foot, into Frederick town, —

Forty flags with their silver stars,
Forty flags with their silver bars,
Flapped in the morning wind: the sun
Of noon looked down and saw not one.

Up rose old Barbara Frietchie then,
Bowed with her fourscore years and ten,
Bravest of all in Frederick town,
She took up the flag the men hauled down;

In her attic window the staff she set,
To show that one heart was loyal yet.
Up the street came the rebel tread,
Stonewall Jackson riding ahead:

Under his slouched hat, left and right,
He glanced, the old flag met his sight.
"Halt!" — the dust-brown ranks stood fast;
"Fire!" — out blazed the rifle blast.

It shivered the window, pane and sash;
It rent the banner with seam and gash,
Quick, as it fell from the broken staff,
Dame Barbara snatched the silken scarf;

She leaned far out on the window-sill,
And shook it forth with a royal will.
"Shoot, if you must, this old gray head,
But spare your country's flag," she said.

A shade of sadness, a blush of shame,
Over the face of the leader came;
The noble nature within him stirred
To life, at that woman's deed and word.

"Who touches a hair of yon gray head,
Dies like a dog. March on!" he said.
All day long through Frederick street
Sounded the tread of marching feet;

All day long the free flag tossed
Over the heads of the rebel host;
Ever its torn folds rose and fell
On the loyal winds, that loved it well;

And through the hill-gaps sunset light
Shone over it with a warm good-night.
Barbara Frietchie's work is o'er,
And the rebel rides on his raid no more.

Honor to her! and let a tear
Fall, for her sake, on Stonewall's bier!
Over Barbara Frietchie's grave,
Flag of Freedom and Union, wave!

Peace and order and beauty draw
Round thy symbol of light and law;
And ever the stars above look down
On thy stars below, in Frederick town!

[RALPH WALDO EMERSON. 1803-1882.]

GOOD-BY, PROUD WORLD.

GOOD-BY, proud world! I 'm going home;
Thou art not my friend; I am not thine:
Too long through weary crowds I roam,—
A river ark on the ocean brine,
Too long I am tossed like the driven foam;
But now, proud world, I 'm going home.

Good-by to Flattery's fawning face;
To Grandeur, with his wise grimace;
To upstart Wealth's averted eye;
To supple office, low and high;
To crowded halls, to court and street;
To frozen hearts, and hasting feet;
To those who go, and those who come:
Good-by, proud world! I 'm going home.

I go to seek my own hearthstone,
Bosomed in yon green hills alone;
A secret lodge in a pleasant land,
Whose groves the frolic fairies planned,
Where arches green, the livelong day,
Echo the blackbird's roundelay,
And evil men have never trod,—
A spot that is sacred to thought and God.

Oh, when I am safe in my sylvan home,
I mock at the pride of Greece and Rome;
And when I am stretched beneath the pines
Where the evening star so holy shines,
I laugh at the lore and pride of man,
At the sophist schools, and the learnèd clan;
For what are they all in their high conceit,
When man in the bush with God may meet?

[OLIVER WENDELL HOLMES. 1809.]

THE BOYS.*

HAS there any old fellow got mixed with the boys?
If there has, take him out, without making a noise.
Hang the almanac's cheat and the catalogue's spite!
Old Time is a liar; we 're twenty to-night.

We 're twenty! We 're twenty! Who says we are more?
He 's tipsy,—young jackanapes!—show him the door!
"Gray temples at twenty?"—Yes! *white* if we please;
Where the snowflakes fall thickest there 's nothing can freeze!

Was it snowing I spoke of? Excuse the mistake!
Look close,—you will see not a sign of a flake!
We want some new garlands for those we have shed,
And these are white roses in place of the red.

We 've a trick, we young fellows, you may have been told,
Of talking (in public) as if we were old;
That boy we call "Doctor," and this we call "Judge!"
It 's a neat little fiction,—of course it 's all fudge.

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* This selection is a poem addressed to the class of 1829, in Harvard College, some thirty years after their graduation.

That fellow 's the "Speaker," the one on the right;
"Mr. Mayor," my young one, how are you to-night?
That 's our "Member of Congress," we say when we chaff;
There 's the "Reverend" — what 's his name? — don't make me laugh.

That boy with the grave mathematical look
Made believe he had written a wonderful book,
And the Royal Society thought it was *true!*
So they chose him right in, — a good joke it was, too!

There 's a boy, we pretend, with a three-decker brain,
That could harness a team with a logical chain;
When he spoke for our manhood in syllabled fire,
We called him "The Justice," but now he 's the "Squire."

And there 's a nice youngster of excellent pith;
Fate tried to conceal him by naming him Smith;
But he shouted a song for the brave and the free, —
Just read on his medal, "My country," "of thee"!

You hear that boy laughing? You think he 's all fun;
But the angels laugh, too, at the good he has done;
The children laugh loud as they troop to his call,
And the poor man that knows him laughs loudest of all.

Yes, we 're boys, — always playing with tongue or with pen;
And I sometimes have asked, shall we ever be men?
Shall we always be youthful and laughing and gay,
Till the last dear companion drops smiling away?

Then here 's to our boyhood, its gold and its gray!
The stars of its winter, the dews of its May!
And when we have done with our life-lasting toys,
Dear Father, take care of Thy children, THE BOYS!

[EDGAR ALLAN POE. 1811–1849.]

THE RAVEN.

ONCE upon a midnight dreary, while I pondered, weak and weary,
Over many a quaint and curious volume of forgotten lore, —
While I nodded, nearly napping, suddenly there came a tapping,
As of some one gently rapping, rapping at my chamber door;
"'T is some visitor," I muttered, "tapping at my chamber door, —
Only this and nothing more."

Ah! distinctly I remember it was in the bleak December,
And each separate dying ember wrought its ghost upon the floor.
Eagerly I wished the morrow; vainly I had sought to borrow
From my books surcease of sorrow, — sorrow for the lost Lenore, —
For the rare and radiant maiden whom the angels name Lenore, —
Nameless here forevermore.

And the silken sad uncertain rustling of each purple curtain
Thrilled me, — filled me with fantastic terrors never felt before;
So that now, to still the beating of my heart, I stood repeating:
"'T is some visitor entreating entrance at my chamber door, —
Some late visitor entreating entrance at my chamber door:
This it is, and nothing more."

Presently my soul grew stronger; hesitating then no longer,
"Sir," said I, "or madam, truly your forgiveness I implore;
But the fact is, I was napping, and so gently you came rapping,
And so faintly you came tapping, tapping at my chamber door,
That I scarce was sure I heard you" — here I opened wide the door —
Darkness there, and nothing more.

Deep into that darkness peering, long I stood there wondering, fearing,
Doubting, dreaming dreams no mortal ever dared to dream before;
But the silence was unbroken, and the stillness gave no token,
And the only word there spoken was the whispered word, "Lenore!"
This I whispered, and an echo murmured back the word, "Lenore!" —
Merely this, and nothing more.

Back into the chamber turning, all my soul within me burning,
Soon again I heard a tapping something louder than before.
"Surely," said I, — "surely that is something at my window lattice;
Let me see, then, what thereat is, and this mystery explore, —
Let my heart be still a moment, and this mystery explore.
'T is the wind, and nothing more."

Open here I flung the shutter, when, with many a flirt and flutter,
In there stepped a stately Raven of the saintly days of yore.
Not the least obeisance made he; not a minute stopped or stayed he;
But, with mien of lord or lady, perched above my chamber door, —
Perched upon a bust of Pallas, just above my chamber door, —
Perched and sat, and nothing more.

Then this ebony bird, beguiling my sad fancy into smiling
By the grave and stern decorum of the countenance it wore,
"Though thy crest be shorn and shaven, thou," I said, "art sure no craven;
Ghastly, grim, and ancient Raven, wandering from the nightly shore,
Tell me what thy lordly name is on the night's Plutonian shore!"
Quoth the Raven: "Never more."

Much I marvelled this ungainly fowl to hear discourse so plainly,
Though its answer little meaning, little relevancy, bore;
For we cannot help agreeing that no living human being
Ever yet was blessed with seeing bird above his chamber door, —
Bird or beast upon the sculptured bust above his chamber door,
With such name as "Never more."

But the Raven, sitting lonely on that placid bust, spoke only
That one word, as if his soul in that one word he did outpour.
Nothing further then he uttered, not a feather then he fluttered,
Till I scarcely more than muttered, "Other friends have flown before, —
On the morrow *he* will leave me, as my hopes have flown before."
Then the bird said: "Never more."

Startled at the stillness broken by reply so aptly spoken,
"Doubtless," said I, "what it utters is its only stock and store,
Caught from some unhappy master, whom unmerciful disaster
Followed fast and followed faster, till his songs one burden bore, —
Till the dirges of his hope that melancholy burden bore,
Of 'Never — never more.'"

But the Raven still beguiling all my sadness into smiling,
Straight I wheeled a cushioned seat in front of bird and bust and door;
Then, upon the velvet sinking, I betook myself to linking
Fancy unto fancy, thinking what this ominous bird of yore —
What this grim, ungainly, ghastly, gaunt, and ominous bird of yore —
Meant in croaking "Never more."

This I sat engaged in guessing, but no syllable expressing
To the fowl whose fiery eyes now burned into my bosom's core;
This and more I sat divining, with my head at ease reclining
On the cushion's velvet lining that the lamplight gloated o'er,
But whose velvet violet lining, with the lamplight gloating o'er,
She shall press — ah, never more!

Then, methought, the air grew denser, perfumed from an unseen censer
Swung by seraphim, whose footfalls tinkled on the tufted floor.
"Wretch!" I cried, "thy god hath lent thee — by these angels he hath sent thee
Respite — respite and nepenthe from thy memories of Lenore!
Quaff, O quaff, this kind nepenthe, and forget this lost Lenore!"
Quoth the Raven: "Never more!"

"Prophet!" said I, "thing of evil! — prophet still, if bird or devil!
Whether tempter sent, or whether tempest tossed thee here ashore,
Desolate, yet all undaunted, on this desert land enchanted,
On this home by horror haunted, — tell me truly, I implore,
Is there — *is* there balm in Gilead? — tell me — tell me, I implore!"
Quoth the Raven: "Never more."

"Prophet!" said I, "thing of evil! — prophet still, if bird or devil!
By that heaven that bends above us, by that God we both adore,
Tell this soul, with sorrow laden, if within the distant Aiden
It shall clasp a sainted maiden, whom the angels name Lenore, —
Clasp a rare and radiant maiden, whom the angels name Lenore?"
Quoth the Raven: "Never more."

"Be that word our sign of parting, bird or fiend!" I shrieked, upstarting:
"Get thee back into the tempest and the night's Plutonian shore!
Leave no black plume as a token of that lie thy soul hath spoken!
Leave my loneliness unbroken! — quit the bust above my door!
Take thy beak from out my heart, and take thy form from off my door!"
Quoth the Raven: "Never more."

And the Raven, never flitting, still is sitting, still is sitting,
On the pallid bust of Pallas, just above my chamber door:
And his eyes have all the seeming of a demon's that is dreaming,
And the lamplight o'er him streaming throws his shadow on the floor;
And my soul from out that shadow that lies floating on the floor,
Shall be lifted — never more!

[James Russell Lowell. 1819.]

EURYDICE.

Heaven's cup held down to me I drain,
The sunshine mounts and spurs my brain;
Bathing in grass, with thirsty eye
I suck the last drop of the sky;
With each hot sense I draw to the lees
The quickening out-door influences,
And empty to each radiant comer
A supernaculum of summer.
Not, Bacchus, all thy grosser juice
Could bring enchantment so profuse.
Though for its press each grape-bunch had
The white feed of Oread.

Through our coarse art gleam, now and then,
The features of angelic men:
'Neath the lewd Satyr's veiling paint
Glows forth the Sybil, Muse, or Saint;
The dauber's botch no more obscures
The mighty master's portraitures.
And who can say what luckier beam
The hidden glory shall redeem,
For what chance clod the soul may wait.
Some moment, nailed on sorrow's cross,
May meditate a whole youth's loss;
Some windfall joy, we know not whence,
Redeem a lifetime's rash expense.

. . . .

I feel ye, childhood's hopes, return,
With olden heats my pulses burn, —
Mine be the self forgetting sweep,
The torrent impulse swift and wild,
Where with Taghkanic's rock-born child
Dares gloriously the dangerous leap,
And, in his sky-descended mood,
Transmutes each drop of sluggish blood,
By touch of bravery's simple wand,
To amethyst and diamond,
Proving himself no bastard slip,
But the true granite-cradled one,
Nursed from the rock's primeval drip,
The cloud-embracing mountain's son!

. . . .

When, heralding life's every phase,
There glowed a goddess-veiling haze,
A plenteous, forewarning grace,
Like that more tender dawn that flies
Before the full moon's ample rise.
Methinks thy parting glory shines
Through yonder grove of singing pines;
At that elm-vista's end I trace
Dimly thy sad leaving-taking face,
Eurydice! Eurydice!
The trembling leaves repeat to me
Eurydice! Eurydice!

RHETORIC.

RHETORIC, in the widest acceptation of the term, comprehends all "*composition in prose*"; in the narrowest sense, it would be limited to "*persuasive speaking*." The ablest modern writers on the subject confine it *generally* and *exclusively* to "argumentative composition," and view it as an offshoot from logic.

Under the title "Argumentative Composition" may be included persuasion, force, sentiment, and the discovery and arrangement of arguments. The utility of rules, therefore, for guidance in formulating the elements of a good composition, is apparent; for it is as necessary to know how to present a subject, for the consideration of whomsoever we would teach, as it is to comprehend it ourselves.

The subjects selected by those beginning the study of argumentative composition should be below rather than above the learner's intellectual capacity; that is, they should never be such as to induce him to string together vague general expressions, conveying no distinct ideas to his own mind, and second-hand sentiments which he does not feel. He may freely take the thoughts of other writers which he thinks will assimilate with those in his own mind; but he must never, as Dr. Whately says, "be tempted to collect *dried specimens*." He should be encouraged to express himself in a free, natural, and simple style, in language grammatically correct.

Letters from one youth to another during vacation, describing the scenes they have visited, the persons they have met, and the impressions made on them, have the tendency to give an unfettered, natural style to youthful compositions.

In writing compositions as an exercise, their subjects, as a rule, should be drawn either from the studies they are engaged in, or from the every-day transactions which form the topics of conversation among their familiar friends. The benefit to be derived from such exercises is not measured by the intrinsic value of the composition, but by the *exercise* of the pupil's mind.

Before commencing a composition, an outline — a skeleton, as it is sometimes called — of the substance of what is to be said should be drawn out. It should briefly and clearly exhibit the several heads of the composition, and should be written like a table of contents, and not in *sentences*. This should guide, but not confine, him in the actual composition. It serves to give a coherence to the matter, and a clear and easy arrangement of its several parts. The analyzing of the compositions of another in the same way is a useful exercise for beginners.

If this system be pursued, and care be taken in the corrections, such exercises in composition will be of lasting advantage, tending to produce clearness of thought and giving play to all the faculties.

The first step in argumentative composition is for the writer to lay down distinctly in his own mind the proposition or propositions to be proved. If several propositions are to be maintained, he must deliberate as to the order in which they should be placed. In this sense a proposition is to be understood as some conclusion to be established *for itself*; those which are established with a view to an ulterior conclusion are called *arguments*.

Arguments are divided, according to the relation of the subject-matter of the premises to that of the conclusion, into ARGUMENTS from EXAMPLE, from TESTIMONY, from CAUSE to EFFECT, from ANALOGY, etc.

ARGUMENTS from *example* are those drawn from the probability that, if two objects resemble one another in *some* respects, they will in the *points in question*. The examples from which arguments are drawn are sometimes *real* and sometimes *invented*.

Of these, *real* examples have *force* from the probability that what has happened once will happen again; but an *invented* example, which is not founded on experience, has no force whatever, as by a fictitious narrative a disputed fact cannot be established.

Arguments from *example* are most commonly drawn from *analogy*, but these are valid only when not carried too far, and when allowed their just weight. A person who sees many analogies is in danger of mistaking fanciful for real ones, and of employing a mere metaphor in place of an argument.

In every example there seems to be a reference to some cause, though that cause may be frequently unknown. For instance, we may, from the marks of Divine benevolence in this world, argue that "the like will be shown in the next," through the intermediate conclusion that "God is benevolent."

In arguments from *testimony*, the great distinction is between testimony to *matters of fact* and to *matters of opinion*, or *doctrines*.

By a *matter of fact* is meant something which might *conceivably* be submitted to the *senses*, and about which it is supposed there could be no disagreement among persons to whose senses it should be submitted; and by a *matter of opinion* is understood anything respecting which an exercise of judgment would be called for on the part of those who should have certain objects before them, and who might conceivably disagree in their judgment thereupon.

Much depends on the character and number of the witnesses, and on the undesigned testimony offered. Slight incidental hints and oblique allusions to any fact have often more weight than distinct, formal assertions of it.

A witness who testifies against his own interests increases the value of his testimony.

Arguments from *cause* to *effect*, or, as they are sometimes called, "arguments from antecedent probability," are those in which the proposition is assumed to be true, and circumstances are brought forward to show why it is true. Thus, if a man were suspected of murder, evidence to show that he had quarrelled with the deceased would be argument from *antecedent probability*.

Arguments of this class are much employed by writers of fiction, and may be used to explain both what has happened and what is likely to happen; reasoning from the past to the present and future, or from the present to the future.

In an argument from *analogy* the two things — viz., the one *from* which, and the one *to* which, we argue — are not necessarily themselves alike, but stand in similar *relations* to some other things. Thus, an egg and a seed are not in themselves alike, but bear a like relation to the parent bird and to her future nestling, on the one hand, and to the old and young plant on the other, respectively; this *relation* being the genus which both fall under: and many arguments might be drawn from this analogy.

The usual and natural way of speaking or writing is to begin by declaring your opinion, and then to subjoin the reasons for it. This method is proper in argumentative composition when the proposition is *well known*, and contains nothing particularly offensive; but, if there be anything in it *offensive* to the prejudices of the hearers, it is usually better to state the arguments first, or at least some of them, and then introduce the conclusion.

A person who wishes to convince others of a proposition must prove it, else he cannot expect them to believe it.

On the other hand, the party on whom the *burden of proof* does *not* rest has in his favor the "*presumption*"; *i. e.*, the proposition which he upholds, taken as true in advance, or till some sufficient reason is adduced against it. The *burden of proof* lies on him who assumes the affirmative of a proposition.

The well-known principle of law, that every man is to be presumed innocent till his guilt is established, means that the *burden of proof* lies with the accuser.

In arranging the proof, a reasoner will do well to follow the order in which the arguments would naturally occur to the mind; and, if he thus places his weakest argument last, he may recapitulate at the end.

A priori arguments are such as might have been employed, not *as* arguments, but to *account for* the fact or principle maintained, supposing its truth granted.

STYLE.

Since there is no *peculiar* kind of grammatical propriety belonging to argumentative composition, we purpose confining our attention to such observations on *style* as have *especial* reference to such composition.

The first requisite of style, not only in rhetorical but in all compositions, is *perspicuity*. A good writer in this respect is one who is able to write not only that which will convey *some* idea to his readers, but that which will convey in the clearest possible manner *the exact* idea which he desires, not leaving us, as it were, to grope for his meaning.

In this connection, however, perspicuity can be regarded only as a *relative* term, and consequently cannot properly be predicated of any work without a tacit reference to the class of readers or hearers for whom it is designed.

Words that might be perfectly clear to scholars and men of science would be out of place and entirely unintelligible to those whose intellectual powers and cultivation are ordinary; and expressions which might be used and perfectly understood in a campaign speech would be ambiguous in a sermon. The writer, aiming at perfect accuracy concerning scientific researches, finds ordinary words, in their ordinary meaning, obscure or ambiguous, and must either employ those which are familiar in an unfamiliar way, or must invent new terms.

For this reason systems of technical language have arisen in the various sciences, which form a medium of communication between scholars. If the meaning, however, can be adequately, or even tolerably, expressed without scientific words, the use of them has an air of pedantic affectation.

Saxon words should always form the groundwork of the composition. They are the words most used in every-day conversation concerning the necessaries of life They are short, expressive, and embrace all the connectives and auxiliary verbs. Simple words come to our lips most naturally, and the long ones are often a bad afterthought.

In regard to the construction of sentences, it is better to abstain from such as are too long. If, however, a sentence be so constructed that the meaning of each part can be taken in as we proceed, its length will be little or no impediment to perspicuity.

Energy, *force*, *vivacity*, and *strength* are terms employed to denote the qualities which give effectiveness to language by keeping the attention of the reader fixed on the subject in hand.

The judicious use of metaphors is conducive to *energy*, which is also promoted by conciseness.

Metaphors may be employed either to elevate or degrade the subject, according to the design of the writer; as, when Simonides was offered a small price for an ode to celebrate a victory in a mule-race, he expressed his contempt for *half-asses*, as they were commonly called, but, when a larger sum was offered, addressed them in an ode as

"Daughters of steeds swift as the storm."

A figure should naturally grow out of a subject, and not appear far-fetched, — fresh enough to give the reader a pleasant surprise, and yet not so strange as to startle him.

The last quality of STYLE to be noticed is ELEGANCE. It constitutes the charm of language that pleases, as distinguished from that which simply instructs or impresses. Elegance requires that all homely and coarse words and phrases should be avoided, even at the expense of circumlocution, though they may be the most apt and forcible that language can supply.

When the two excellences of style, *energy* and *elegance*, are at variance, the former is generally to be preferred. A writer should endeavor to maintain the appearance of expressing himself, not as if he *wanted to say something*, but as if he *had something to say*: and a strikingly elegant expression may sometimes convey a suspicion that it was introduced for the sake of its *elegance*.

Perspicuity is required in all compositions, and may be considered as the ultimate end of a scientific writer.

Of the poet, again, as such, the ultimate end is to give pleasure, and accordingly elegance or beauty will be the appropriate qualities of his language.

The safest rule is, never, during the act of composition, to study elegance or think about it at all. The best models should be studied, the beauties of their style marked, and thus the writer may insensibly catch the habit of expressing himself with elegance. Perspicuity should be carefully studied as he goes along; he may also, though more cautiously, aim in like manner at energy: but if he betray an endeavor after elegance, he will offend more than by the rudest simplicity.

LOGIC.

LOGIC is the science, and also the art, of reasoning correctly. It investigates the principles on which argumentation is conducted, and furnishes rules to secure the mind from error in its deductions. As the most appropriate intellectual occupation of man, as man, is to reason, and as all are occupied in deducing, well or ill, conclusions from premises, each concerning the subject of his own particular business, the rules that can be deduced from that system, for the better regulation of the process, is worthy the attention, not of the members of this or that profession merely, but of every one who is desirous of possessing a cultivated mind.

Logic lays down some general rules of reasoning applicable to all cases, by which a person may be enabled the more readily and clearly to state the grounds of his own conviction, or of his objections to the arguments of an opponent, instead of arguing at random, without any fixed and acknowledged principles to guide his procedure.

Inductive reasoning enables us to ascertain what is true of many different things. Our senses tell us what takes place around us; and then, by proper reasoning, we may often discover the laws of nature in consequence of which they happen. If we observe that clouds and fogs, rain and hail, are composed of water, which seems to come out of the air, by a proper course of inquiry we may find that all moist air, when cooled, produces particles of water; hence that clouds, fogs, etc., have a common origin, and are only the moisture of the atmosphere condensed under different circumstances.

Deductive reasoning is just the opposite of *inductive*. By it we infer from any law of nature what will happen in consequence of it. If we know that moist air, when cooled, produces particles of water, we may infer that an iced bottle of wine will, in summer, become covered with dew.

As inductive reasoning cannot be understood without a knowledge of deductive reasoning, we will proceed to consider briefly in what the latter consists.

In every argument or case of reasoning, it will be found that every conclusion is deduced, in reality, from two other propositions, which are called premises; for, though one of these may be, and commonly is, suppressed, it must nevertheless be understood as admitted, as can easily be seen by supposing the denial of the suppressed premise, which will at once invalidate the argument. For instance, if any one, from perceiving that "the ox has horns on the head," infers that "it must ruminate," though he may not be aware in his own mind of the existence of any other premise, he will readily understand, if it be *denied* that "all animals with horns on the head ruminate," that the affirmative of that proposition is necessary to the validity of the argument. Expressed at length, the argument would stand thus: —

All animals with horns on the head ruminate;
The ox has horns on its head;
Therefore the ox ruminates.

Of the three facts thus stated, if we know the first two we can deduce the third from them, and we are thus said to infer or reason.

To reason, then, is to obtain facts from other facts.

The three sentences, each of which state a fact, are called propositions. The first proposition contains two descriptions of things compared together; namely, "animals with horns on the head" and "animals that ruminate," and these are called the *terms*, or ends, of the proposition. The adjective *all* we call the sign of the *quantity*.

We find, on examination, that an argument of this kind is composed of three propositions and of three terms, and that each proposition is made by joining two terms.

The last proposition, which is gathered from the first two, is called the *conclusion;* and the three propositions, stated at full length and in their natural order, are called a *syllogism.*

The three parts of *deductive logic,* therefore, treat of *terms, propositions,* and *syllogisms.*

Terms are classed as *singular, collective, general, concrete, abstract, positive,* and *negative.*

A *singular term* is the name only of a single person or thing; as, the Emperor of Brazil.

A *collective term* is the name of many things collected into one whole; as, the West Indies, which is the name, not of any one island, but of many islands.

General terms are the names of things of which many exist; thus, "dollar" is not the name of any one single thing, but of many millions of things.

A *concrete term* is a name which stands for a thing; as, this table.

An *abstract term* is a name which stands for a quality of a thing; as, this table is *square.*

Positive and *negative* terms are opposites; thus, the term *metallic,* applied to any substance, is positive, while *non-metallic* is negative.

A *syllogism* is, as we have seen, resolvable into three propositions, and each proposition containing two terms. Of these terms, that which is spoken of is called the *subject;* that which is said of it is called the *predicate.* Logically the subject is placed *first* and the predicate *last,* and in the middle the *copula,* which indicates the act of judgment, as by it the predicate is affirmed or denied of the subject.

The *copula* must be either *is* or *is not,* the substantive verb being the only verb recognized by logic: all others are resolvable by means of the verb *to be* and a participle or adjective; as, the rebels conquered. The word *conquered* is both copula and predicate, being equivalent to *were* (cop.) *victorious* (pred.).

There are various kinds of propositions: —

An *affirmative proposition* is one whose *copula* is affirmative; as, horses *are* useful.

A *negative proposition* is one whose copula is negative; as, man *is not* perfect.

Hypothetical propositions assert the predicate of the subject under some circumstances; as, if elephants be tamed, *they will work.*

A *universal proposition* is one in which the predicate is said of the *whole* of the subject; as, *all* tyrants are miserable.

A *particular proposition* is one in which the predicate is said of a part only of the subject; as, *some* men are rich.

The subjects of *universal propositions* are said to be *distributed,* being understood to stand each for all the things which can be included under the term. The subjects of *particular propositions* are *not distributed.*

There are four principal kinds of propositions; viz., *universal affirmative, universal negative, particular affirmative,* and *particular negative.*

The *distribution* or *non-distribution* of the predicate depends, not on the quantity, but on the quality of the proposition; for, if any part of the predicate agrees with the subject, it must be *affirmed* and not *denied* of the subject. Therefore it is sufficient that *some part* of the subject *agrees* with the predicate for an affirmative proposition to be true; and it is necessary, for a negative to be true, that the *whole* of the predicate should *disagree* with the subject.

The two practical rules, then, respecting distribution, are, —

1. All *universal* propositions distribute the *subject,* but *particular* propositions do not.
2. All *negative* propositions distribute the *predicate,* but *affirmative* propositions do not.

From this it will be readily seen that a particular affirmative proposition distributes neither its subject nor its predicate. For example: —

Some flowers are rare.

The subject "flowers" is undistributed, because the proposition is particular. The predicate is undistributed; for it cannot be supposed that we intended to say that "some flowers are the only rare things." The proposition, therefore, must be taken as "some flowers are some rare things," or "some flowers are a part of rare things." The predicate and subject are both undistributed.

A particular negative proposition has the subject undistributed and the predicate distributed; as, some flowers are *not* rare. This really means that "some flowers are not any rare things," so that the predicate "rare things" is taken universally. It is to be borne in mind that, though it is affirmed that "some flowers" are *not* rare, we are not justified in concluding that some *other* flowers *are* rare; a statement which, however true in itself, we are not warranted in inferring.

The general rules of the syllogism are six in number, as follows: —

1. Every syllogism has three terms; viz., the *middle term*, and the two terms which appear respectively in the premises, and as the extremes of the conclusion.

The subject of the conclusion is called the *minor term;* its predicate, the *major term;* and the *middle term* is that with which each of the others is separately compared, in order to judge of their agreement or disagreement with each other.

2. *The three propositions in every syllogism are called,* — 1st, The *major premise,* in which the major term is compared with the middle; 2d, The *minor premise,* in which the minor term is compared with the middle; and, 3d, The *conclusion,* in which the minor term is compared with the major.

3. *The middle term must be distributed once at least in the premises;* that is, it must be either the subject of a universal, or the predicate of a negative, proposition: and if one extreme has been compared to a *part* of the middle term, and another to the *whole* of it, they must have been both compared to the *same.*

The *major* term is the *predicate* of the conclusion, the *minor* term the *subject* of the conclusion, and the middle term is never in the conclusion.

4. *No term must be distributed in the conclusion which was not distributed in one of the premises.* If we say some quadrupeds are carnivorous, and all quadrupeds have warm blood, we must not conclude that all which have warm blood are carnivorous. The minor premise, "All quadrupeds have warm blood," is an affirmative proposition, which does not distribute its predicate, — that is, does not refer to all things which have warm blood.

5. *From two negative premises nothing can be inferred.*

In negative premises the middle term disagrees with both extremes, so that the classes of things denoted by the terms are either wholly or partly separated from each other.

An apple is not a mineral, }
A bird is not a mineral, } are two propositions from which nothing can be proved.

6. *If one premise be negative, the conclusion must be negative; and a negative conclusion cannot be deduced unless one of the premises be negative.*

In the *negative* premise, the *middle term* disagrees with one of the extremes; and in the other premise, which must be affirmative, it agrees with the other extreme: consequently, the extremes disagreeing with each other, the conclusion is negative.

By the six rules above quoted, all arguments supposed to be syllogisms are to be tried; and, by practice in their application, the learner will be quick in deciding whether arguments are good syllogisms or not.

Do the following premises, for example, allow of the conclusion drawn from them? —

Every capital is the seat of government;
Boston is not the seat of government;
Therefore Boston is not a capital.

In this syllogism the middle term, or that which does not appear in the conclusion, is, "is the seat of government." The minor term is "Boston," and the major term "capital." We thus find there are but three terms, which accords with the first rule; and three propositions, which accords with the second rule. The third rule necessitates the distribution of the middle term at least once; and this is so from the fact of the second premise, "Boston is not the seat of government," being a negative proposition, and therefore distributes its predicate. The fourth rule is obeyed, inasmuch as "Boston" and "capital" are both distributed in the conclusion, and also in the premises. The fifth rule is conformed to, as the first premise is affirmative. The sixth is also complied with. One premise being negative, the conclusion is negative.

All vegetables grow;
All trees grow;
Therefore all trees are vegetables.

Both these propositions are affirmative, and, as such, do not distribute their predicates; consequently the third rule of the syllogism is broken. This is called a *fallacy of an undistributed middle term.*

The acquisition of knowledge is laudable,
The acquisition of wealth is not the acquisition of knowledge;
Therefore the acquisition of wealth is not laudable.

In this argument the number of terms and propositions is correct; and the middle term, "the acquisition of knowledge," is distributed in the second premise, which is negative. The conclusion is also negative. Thus far no rule is broken. But we find that the conclusion, when negative, distributes its predicate "laudable"; while the first premise, of which it is also the predicate, does not distribute it. The fourth rule is therefore broken, and the argument we are discussing is not a good syllogism.

From the six rules of the syllogism already given, two minor rules are deduced: —

1st. That from two particular propositions nothing can be proved; as, —

Some animals are ferocious;
Some dogs are not ferocious;
Therefore some dogs are not animals.

"Animals" is distributed in the conclusion, and undistributed in the premises, which breaks Rule 4.

2d. If one of the premises be particular, the conclusion must be particular; as, —

All who render service to their country deserve to be remembered;
Some statesmen render service to their country;
Therefore some statesmen deserve to be remembered.

To draw a universal conclusion would be to employ the whole of a term in the conclusion when you had employed only part of it in the premise, which violates the fourth rule.

In an argument stated in the form of a syllogism, it is impossible for any one who admits both premises to avoid admitting the conclusion.

In examining arguments, the question respecting their validity is not, *is the conclusion true?* but, *does it follow from the premises adduced?* And, in exposing a fallacy to those who are unacquainted with logical rules, the simplest way is to bring forward a similar one with an obviously absurd conclusion.

The maxim resulting from the examination of a syllogism regularly stated (and of the application of which every valid argument is in reality an instance), is "that whatever is affirmed or denied universally, of any class of things, may in like manner be affirmed or denied of anything comprehended in that class."

A *fallacy* is commonly understood to be any unsound mode of arguing which appears to demand our conviction, and to be decisive of the question in hand, when in reality it is not. Fallacies are occasioned in most cases by the use of ambiguous terms, or words with more than one distinct meaning.

Erroneous conclusions are frequently reached by using terms which have both a collective and a general meaning. For instance, the word *all* may be so used as to cause differences of opinion regarding its application. I say, "All of those things are sufficient to determine this fact." Do I mean that each one is sufficient, or that the combined influence produces the conclusion? The reply of educated persons would be, "Of course *all* means the *whole*, not any *one*." Certainly; but did the speaker or writer understand or intend this, and would the public generally so judge, considering the tone of the speaker or the subject matter?

Again, "All white sheep eat a great deal more than black sheep." Why? Because the number of the former is much larger.

To argue from premises containing an ambiguous word, is using in fact four terms in the same syllogism, which our rules forbid. We sometimes argue wrongly that what is true of many things is also true of some special thing which does not properly come under that class.

Many erroneously conclude that the failure to prove an assumption tends to establish an opposite conclusion. If at a trial for murder an attempt to prove an alibi fails, this fact in itself should not be considered proof of presence at the place where the murder was committed; yet juries are liable to thus conclude. An assumption may be a fact notwithstanding inability to prove it.

All correct reasoning consists in the substitution of like things for like things, and inferring that what is affirmed or denied of one can be affirmed or denied of all which are similar to it.

All incorrect reasoning consists in the substitution of one thing for another when there is not the required likeness between them.

ELOCUTION.

ELOCUTION is the power of expressing thought by speech clearly, forcibly, and agreeably. The effect of a perfect composition may be destroyed by a faulty delivery; while one which is inferior in both matter and style may, if better spoken, produce a more powerful effect.

The requisites of elocution are,

Perspicuity, *energy*, *elegance*, and *correct enunciation* in opposition both to indistinct utterance and to vulgar and provincial pronunciation. Systematic training and rigid practice are necessary to properly develop the voice, and to secure that distinctness of articulation so essential to good elocution. The success which attended Demosthenes in his efforts to overcome his defects of voice and manner, by practising with pebbles in his mouth by the roaring sea, is matter of history.

There is a marked distinction between the two branches of delivery; namely, *reading aloud* and *speaking*. The object of *correct reading* is to convey to the hearers, through the medium of the ear, what is conveyed to the reader by the eye; but a *speaker*, in uttering his own sentiments, conveys, by the sounds which reach the ear, the idea that what is said is the immediate effusion of his own mind, which he is desirous of imparting to others.

In order to acquire the best style of delivery, it is necessary, in practice, to fix the attention on the *voice;* to study analytically the emphasis, tones, pauses, degrees of loudness, etc., which give the proper effect to each passage. Having had thorough discipline in this way, good elocution becomes, as it were, second nature; and, when the real occasion arises, the speaker need not abstract his mind from his *matter* to think of his *manner*. Many speakers, however, fail in their efforts to so train themselves, and have a delivery which is neither natural nor artificial, and which is an infliction upon an audience. Steady, persistent effort is necessary to achieve even moderate success; for, if a speaker cannot deliver a speech without thinking on *how* he is doing it, he had better not try it at all.

He who not only understands fully what he is reading, but is earnestly occupying his mind with the matter of it, will be likely to read as if he understood it, and thus to make others understand it; and, if he has had any elocutionary training, the inflections and modulations which give it a charm to the hearer will be supplied involuntarily.

The instructor in elocution should give admonitions, when needed, by saying, " read that passage as if you understood it: read this suitably to a *command;* that, to an *interrogation*, etc. Express the scorn, the exultation, the earnestness, etc., of that passage, as if you were expressing such a feeling of your own in your own words," etc.

Articulation is the distinct utterance of all the oral elements in syllables and words according to the approved custom of pronouncing them. Daily practice upon examples like the following will tend to produce good articulation: —

The foul*est* *st*ain an*d* scand*al* of our nature becomes i*ts* boast.
One *m*urder *m*akes a villain; *m*illions, a hero.
The *sl*eepy *sl*uggard *si*ts *sl*umbering *si*lently.
Now on his couch he *shr*unk and *sh*ivered.
Morn, that now meet'*st* the ori*ent* sun, now fly'*st*.

The distinctness with which a speaker may be heard depends, not so much on loudness of voice as on perfectness of articulation.

The requisite degree of loudness will be best obtained, not by thinking about the voice, but by *looking* at the most *distant* of the hearers, and addressing one's self especially to him. The voice rises spontaneously when we are speaking to a person not very near.

INFLECTIONS OR SLIDES.

In speaking, the voice is constantly sliding upward and downward on the vowel sounds.

When asking a direct question, the voice glides from low to high tones, and in the answer it slides downward. Thus, one asks another at a distance what he wants? —

The bát? No! the kìte. The movement of the voice on the word "bat" is a *rising* inflection; that upon "No" and "kite" is *falling.*

When anything sad is uttered, the slide or inflection is *semitonic* or *minor;* as, —

Give me three grains of córn, mother,
  Only three grains of córn.
Come nearer to my sìde, mother,
  Come nearer to my sìde.

In ironical or ambiguous expressions, the voice waves upward and downward on the same sound, producing the *circumflex* inflection, called the *rising* or *falling*, as the voice moves up or down at its close; as, —

Dŏ! I tell you, I rather guess
She was a wŏnder, and nothing less!

The little witch is evil-eyed!
Her mŏther only killed a côw,
Or witched a chûrn or dâiry-pan;
But shĕ, forsooth, must churn a mân!

Monotone is a sameness of tone, or an unvaried pitch of the voice, in reading or speaking.

This intonation in speaking is used properly in the expression of sublimity and awe, and in emotions which imply vastness and force; as, —

Hōly! hōly! hōly! Lōrd Gōd of hōsts!

I am thy father's spirit;
Doomed for a certain term to walk the night,
And, for the day, confined to fast in fires,
Till the foul crimes, done in my days of nature,
Are burnt and purged away.

When actors repeat passages aside, they adopt the monotone. By being in a lower tone, it conveys the idea of being inaudible to those with them in the scene; and, by being in a monotone, becomes audible to the whole house. As a rule, the monotone requires a low tone of voice, with the utterance slow and prolonged. It is by far the best tone to practise in the cultivation of the voice.

FORCE.

All sounds, from the gentlest to the most vehement, should always be smooth and musical, and the intonation pleasant and natural.

The degree of force necessary to render any given passage properly depends upon the space to be filled by the reader's voice, upon the number of persons to be addressed, and upon the emotion expressed.

Force is generally divided into *gentle, moderate, loud,* and *very loud.*

Gentle (very soft).

Flow gently, sweet Afton, amang thy green braes,
Flow gently, I 'll sing thee a song in thy praise:
My Mary 's asleep by thy murmuring stream;
Flow gently, sweet Afton, disturb not her dream.

Moderate.

A man must serve his tune to every trade
Save censure: critics all are ready made.

Loud.

Fear ye foes who kill for hire?
Will ye to your homes retire?
Look behind you! — they 're afire!
And, before you, see
Who have done it! From the vale
On they come! And will ye quail?
Leaden rain and iron hail
Let their welcome be!

Very Loud.

Ye guards of liberty!
I 'm with you once again. I call to you
With all my voice.

MODULATION.

Modulation is the art of inflecting the voice musically and agreeably. It is the opposite of monotony, and is generally called the *pitch.*

For convenience it is divided into *high, middle, low,* and *very low.*

The *high pitch* is used in expressing the extremes of fear, grief, and pain, also gay and joyous emotions; as, —

Ye sons of freedom, wake to glory!
Hark! hark! what myriads bid you rise!
Your children, wives, and grandsires hoary, —
Behold their tears and hear their cries!

The *middle pitch* is generally used in ordinary conversation, and in passages which are void of emotion; as, —

How peaceful the grave! — its quiet, how deep!
Its zephyrs breathe calmly, and soft is its sleep;
And flow'rets perfume it with ether.

The *low pitch* is used in expressing solemnity, awe, grief, or horror; as, —

Calm is the morn without a sound,
Calm as to suit a calmer grief,
And only through the faded leaf
The chestnut pattering to the ground.

The pitch descends in proportion to the gravity or solemnity of a passage; as, —

There was a sound so fine,
There 's nought 'twixt it and silence.

RATE.

The rate at which a given passage should be uttered depends on the nature of the thought which it conveys. Dignified passages require to be expressed with slowness and regularity of movement, while passages which embody violent passion require irregular and impulsive speech. As a rule, slow rate should be practised, as the speaker thereby has a self-possessed air, can articulate distinctly, and has a reserved power which he can draw on when the nature of a passage demands it.

Quick.

The combat deepens. On, ye brave,
Who rush to glory, or the grave!
Wave, Munich! all thy banners wave,
And charge with all thy chivalry!

Very Quick.

O, then, I see, Queen Mab hath been with you:
She is the fairies' midwife; and she comes
In shape no bigger than an agate stone
On the forefinger of an alderman,
Drawn with a team of little atomies
Athwart men's noses as they lie asleep.

Slow.

Yet a few days, and thee
The all-beholding sun shall see no more
In all his course; nor yet in the cold ground,
Where thy pale form was laid with many tears,
Nor in the embrace of ocean, shall exist
Thy image.

Very Slow.

I had a dream which was not all a dream:
The bright sun was extinguished; and the stars
Did wander darkling in the eternal space,
Rayless and pathless; and the icy earth
Swung blind and blackening in the moonless air;
Morn came, and went, and came, and brought no day.

TONE.

The tones of the voice express the emotions, even though the language be not properly understood. The cry of pain, of grief, or of despair can be readily recognized, even though the person uttering them be not seen or distinctly heard.

The qualities of voice generally used in reading or speaking are, the *pure tone*, the *orotund*, the *aspirated*, and the *guttural*.

The *pure tone* is that generally used in conversation, and is adapted to express emotions of love, joy, and tranquillity; as, —

And on that cheek and o'er that brow
So soft, so calm, yet eloquent,
The smiles that win, the tints that glow,
But tell of days in goodness spent, —
A mind at peace with all below,
A heart whose love is innocent.

The *orotund* is a deep, round tone of voice, used in expressing sublimity, grandeur, and pathetic emotions, and is adapted to declamation; as, —

And thou, O silent mountain, sole and bare,
O, blacker than the darkness, all the night,
And visited all night by troops of stars,
Or when they climb the sky, or when they sink,
Companion of the morning star at dawn,
Co-herald! wake, O wake, and utter praise!

The *aspirated* or *pectoral tone* is used to express anger, despair, fear, or great solemnity. It has a whispering utterance, and is usually accompanied by slow time; as, —

Did ye not hear it? No; 't was but the wind,
Or the car rattling o'er the stony street.
On with the dance! let joy be unconfined!
No sleep till morn, when youth and pleasure meet,
To chase the glowing hours with flying feet! —
But hark! that heavy sound breaks in once more,
As if the clouds its echo would repeat;
And nearer, clearer, deadlier than before!
Arm! arm! it is — it is the cannon's opening roar!

The *guttural* is a deep tone of voice, having an explosive resonance in the throat, and is used to express contempt, hatred, and aversion; as,—

How like a fawning publican he looks!
I hate him, for he is a Christian;
But more for that, in low simplicity,
He lends out money gratis, and brings down
The rate of usuance with us here in Venice.
If I can catch him once upon the hip,
I will feed fat the ancient grudge I bear him!
He hates our sacred nation: and he rails,
Even there where merchants most do congregate,
On me, my bargains, and my well-won thrift,
Which he calls interest. Cursed be my tribe
If I forgive him!

STRESS.

Stress is the application of force to a tone. It is of three kinds,—the *radical,* the *median,* and the *increasing.*

The *radical* stress is usually explosive, and is used in sudden emotions and in the expression of positive convictions; as,—

Charge, Chester, charge! On, Stanley, on!
Were the last words of Marmion.

The *median* stress is usually expulsive, and expands towards the middle of a sound and disappears towards the close. It is used principally in the expression of calm and fervent emotions, and has a gliding, graceful movement; as,—

How fine has the day been! how bright was the sun!
How lovely and joyful the course that he run,
Though he rose in a mist when his race he begun,
And there followed some droppings of rain!
But now the fair traveller 's come to the west,
His rays are all gold, and his beauties are best:
He paints the sky gay as he sinks to his rest,
And foretells a bright rising again.

The *increasing* stress begins with the effusive, increases till the completion of the sound, and finishes with the explosive; as,—

Ay, lady, 't was my word.
Thou wretched, rash, intruding fool, farewell!
I took thee for thy betters; take thy fortune:
Thou find'st to be too busy is some danger.
Leave wringing of your hands, Peace! sit you down,
And let me wring your heart: for so I shall,
If it be made of penetrable stuff,
If damned custom have not brazed it so
That it is proof and bulwark against sense.

Thou slave! thou wretch! thou coward!
Thou little valiant, great in villany!
Thou ever strong upon the stronger side!
Thou Fortune's champion, that dost never fight
But when her humorous ladyship is by
To teach thee safety.

PHONOGRAPHY

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PHONOGRAPHY is the system of short-hand writing based on spelling and writing words strictly by sound. The phonographic alphabet contains forty letters or signs, because there are forty distinct, different elementary sounds in our language. Those signs are not arranged as in the common *a b c* alphabet, but are separated into two groups, called "consonants" and "vowels." The consonants are written with stroke or stem signs, and the vowels with dots and short dashes placed at the side of the consonant-stems. There are four diphthongs, and they are written with little angles.

PHONOGRAPHIC ALPHABET.

CONSONANTS.

SIGN.	NAME.	SOUND.	SIGN.	NAME.	SOUND.
╲	Pee,	p in pay.	)	Zee,	z in zeal.
╲	Bee,	b in bay.	◞	Ish,	sh in shun.
│	Tee,	t in tie.	**◞**	Zhee,	s in vision.
┃	Dee,	d in die.	⌒	Em,	m in May.
╱	Chay,	ch in chain.	‿	En,	n in no.
╱	Jay,	j in Jane.	**‿**	Ing,	ng in sing.
—	Kay,	k in kale.	◜	Lee,	l in lay.
━	Gay,	g in gale.	◝	Er,	r in oar.
◟	Ef,	f in few.	╱	Ree,	r in roe.
◟	Vee,	v in view.	◝	Way,	w in we.
(	Ith,	th in thigh.	**◜**	Yay,	y in you.
(	Thee,	th in thy.	⌒	Hay,	h in he.
)	Ess,	s in seal.			

VOWELS.

·│ ·◜	ah,	as in arm.	·│ ·◜	ă,	as in air.
·│ ·◜	a,	as in ale.	·│ ·◜	ĕ,	as in met.
·│ ·◜	ē,	as in ear.	·│ ·◜	ĭ,	as in pin.
-│ -◜	aw,	as in fall.	-│ -◜	ŏ,	as in lost.
-│ -◜	ō,	as in note.	-│ -◜	ŭ,	as in cur.
-│ -◜	ōō,	as in food.	-│ -◜	ŏŏ,	as in foot.

DIPHTHONGS.

˅│ ˅◜	Sound of ai in aisle and i in fine.
<│ <◜	" " oy " boy " oi " boil.
˪│ ˪◜	" " ough " plough " ow " cow.
>│ >◜	" " iew " view " u " tube.

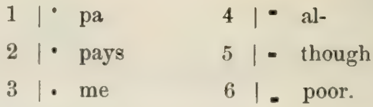
Always write phonography on ruled paper if it can be had. Wide ruled paper is the best. Accustom yourself to the use of both pen and pencil, which you may hold either between the thumb and first finger or between the first and second fingers, according to what your practice is in writing longhand. A pen writes phonographic outlines best when it is turned so that the outer edge of the left nib is a little nearer the paper than the outer edge of the other nib is; that being the position that facilitates the shading of *bee* and *gay*. At first write slowly, aiming at precision only, and make the stems about one fifth of an inch in length. Afterwards they may be reduced a little. Shade the heavy curves most in the middle, and taper them gradually to the ends, and the heavy straight stems with an even thickness from beginning to end. The illustrations of this article are models for imitation in all respects.

In writing any word in phonography the consonant part is always written first, and then the vowel or vowels belonging to the word are written near the consonant stem or stems. Thus, in writing the words *take* and *attic*, both words having the same consonant sounds, namely *t* and *k*, and consequently the same outlines, we write the stems *tee* and *kay* without taking off the pen, and then write in the signs of the vowel sounds, *take* having but one and *attic* two.

All of the upright or slanting stems are written from the top downward, except *ree*, which is invariably struck upward, and the stems for *sh* and *l*, which are sometimes written upward and sometimes downward. When not joined to another stem, however, the stem for *sh* is always written downward, and that for *l*, always upward. When written downward, these stems are called respectively *ish* and *el;* and when written upward, *shee* and *lee*. *Chay* (downward) and *ree* (upward), when standing alone, are distinguished by making the latter considerably more slanting than the other. When joined to other stems, this precaution is not necessary. Be careful in writing the six upright stems to make them exactly perpendicular. Beginners, unless accustomed to writing what is called "back-hand," are apt to lean these stems to the right.

Use the short-hand illustrations in this article in the following manner: While reading the phonography, cover with a card the line of printed key below, and while writing the key words in phonography, cover in the same way the line of phonography above. Compare frequently your own writing with the printed phonography, to see that you have made a fac-simile of it.

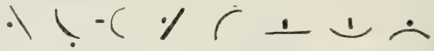
The six long vowels are heard in the words, "Pa pays me al-though poor." The first three are written with a heavy dot, placed either at the beginning, middle, or end of the consonant stem, and the last three with a heavy short dash, similarly placed, as here shown:—



These vowel signs represent sounds as follows: No. 1, the vowel heard in car, arm, yard, harp, farce, large, park, carve, march, harsh, scarf, snarl, etc. No. 2, the vowel heard in ape, ate, ace, ale, bake, came, paste, plain, state, shade, scale, strange, etc. No. 3, the vowel heard in be, meet, feed, feel, deep, peach, speak, beast, teeth, dream, cheer, breeze, etc. No. 4, the vowel heard in all, spawn, caught, fall, cause, small, horse, north, broad, talk, salt, warm, etc. No. 5, the vowel heard in goat, joke, tone, road, ope, globe, quote, though, rogue, clothe, spoke, swore, etc. No. 6, the vowel heard in do, move, soon, pool, boot, goose, whom, group, ruse, boon, tomb, youth, etc.

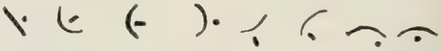
When a stem is written upward instead of downward, the vowel numbers commence at the bottom, that is, at the beginning of the stem, and run up instead of down.

When a vowel occurs before a consonant it is written to the left of it if its stem is upright or slanting, and above, if the stem is horizontal; thus:—



ape, eve, oath, age, eel, ache, own, aim.

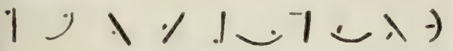
When a vowel occurs after a consonant it is written to the right of it if its stem is upright or slanting, and below, if the stem is horizontal; thus:—



bay, foe, though, say, shoe, law, me, hay.

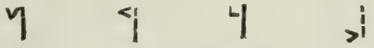
The dash vowels are written at right angles to the part of the stem opposite which they are placed; and both dots and dashes should be written at a little distance from the stem.

The six short vowels are heard in the words, "Pat went in on one foot." The first three are written with a light dot, and the last three with a light short dash placed to the consonant stem in the same manner as the heavy dots and dashes. Each of the short vowels resembles in sound the long vowel with which it is paired, as is illustrated by the words car, cat; mote, met; eat, it; naught, not; note, nut; food, foot. Examples: —



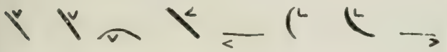
at, ash, ebb, edge, it, in, odd, on, up, us.

There are four diphthongs (dĭf-thongs) in the English language; namely, the sounds of *ai* in *aisle* (or *i* in *mite*, *y* in *my*), *oi* in *boil* (or *oy* in *boy*), *ow* in *now*, (or *ough* in *bough*), and *ew* in *new* (or *u* in *cube*). Their signs are: —



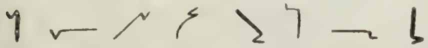
i, *oi*, *ow*, *ew*.

These angles always point the same way, no matter what may be the direction of the stem to which they are written. Examples: —



pie, by, my, boy, coy, thou, vow, cue.

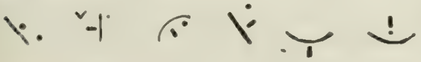
When convenient, the signs of the diphthongs may be joined to the stems; thus: —



eyed, Ike, rye, oil, boy, out, cow, due.

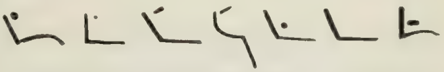
When joined initially, they are read before any other vowel sign placed to the stem; when joined finally, they are read after any such vowel sign.

When two vowels occur together, the sign of the one that is pronounced nearest the consonant is written a little nearer the stem than the other; thus: —

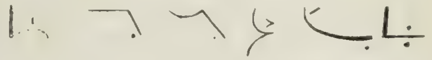


payee, iota, Leo, boa, Noah, Owen.

When a vowel occurs between two consonant stems, it is written after and to the first stem if it is a first-place or a *long* second-place vowel, and before and to the second stem if it is a third-place or a *short* second-place vowel. When two vowels occur together between stems, write the sign of the first to the first stem, and the sign of the second to the second stem. If a vowel ends a word, it is placed after the last stem. Examples: —



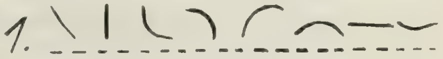
palm, tack, balk, fop, bake, beck, dome,



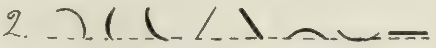
dumb, keep, nip, fuel, foggy, decay.

The outlines of words are written with reference to the line or ruling of the paper, in three different positions; namely, *first* position, above the line; *second* position, on the line; *third* position, through or under the line. The first position of any upright or slanting stem is above the line about half the length of a *tee;* the second position of *any* simple consonant stem is resting on the line; and the third position of any upright or slanting stem is across the line, being halved by it. The first and third positions of horizontal stems are: *first* position, above the line, about the height of a *tee; third* position, just below but not touching the line. Examples: —

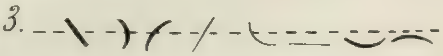
1st position:



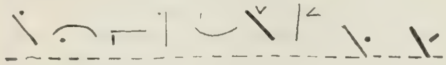
2d position:



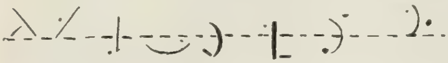
3d position:



The outline of a word is written in the position indicated by its vowel. If its vowel is first-place, and the word has but one consonant stem, it is written in the first position; if its vowel is second-place, in the second position; if its vowel is third-place, in the third position. If the word contains more than one vowel sound, the place of the *accented* vowel determines the position of the outline. Examples: —

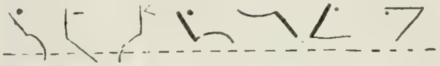


pa, ma, caw, at, on, by, toy, pay, beau,

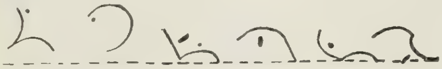


up, etch, it, in, ooze, ado, Esaw, assay.

If the outline is composed of more than one stem, the *first* stem is written in the position indicated by the vowel, and the other stems follow after as they happen to come. This rule applies and governs in all cases except when the outline *begins with a horizontal stem which is followed by an upright or slanting stem.* Then the first upright or slanting stem is written in position, and the horizontal stem raised or lowered, as the case may be, so as to be on a level with its starting point. Examples: —

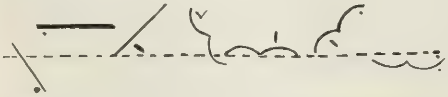


par, top, toil, balm, nab, Jack, catch,



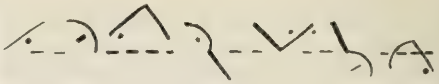
sham, mash, poem, mope, fame, muff.

A straight stem is repeated by making it twice as long as a single stem, and a curved stem by making it twice with an angle between. Examples: —

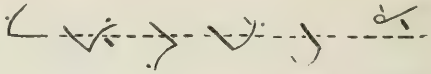


peep, gag, roar, fife, mum, lowly, ninny.

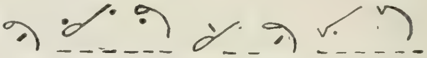
In regard to the use of the two signs for *r*, and of upward and downward *l* and *sh*, the general rule is that the upward sign is used before a vowel and the downward sign after a vowel; thus: —



ray, oar, rap, herb, berry, burr, leap,



elk, pillow, pill, bushy, bush, sorrow,



sore, starry, star, story, store, Ira, ire.

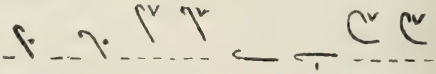
INITIAL HOOKS.

When *l* or *r* follows another consonant with no vowel between, it blends with it and the two are sounded together, as in the words *play*, *blow*, *addle*, *clay*, *glee*, *fly*, *pry*, *brow*, *true*, *dray*, *tree*, *cry*, *gray*, *fry*, *throw*, *shrew*, etc.

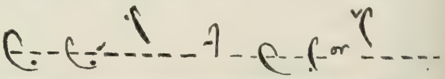
These double consonants are written in phonography by putting a hook at the beginning of the stem of the *first* consonant. On any straight stem, a small initial hook, made by a motion from the right over to the left, indicates that *l* follows; and a small initial hook on the other side indicates that *r* follows.

On curved stems both hooks are written on the inner or concave side, and are distinguished by making it large for *l* and small for *r*. Large hooks on straight stems, in place of the *l* and *r* hooks, indicate in like manner, respectively, that *w* and *y* follow.

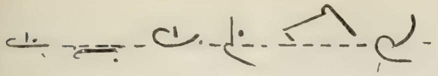
When it is desired to write a vowel so as to be read between a stem and its initial hook, it is done as follows: Dot vowels are written with circles, and placed *before* the stem for the long vowels, and *after*, for the short vowels; the dash vowels are written across or at the end of the stem. Examples: —



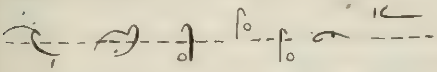
play, pray, ply, pry, glow, grow, fly, fry,



flee, free, apple, odor, evil, either or ither,



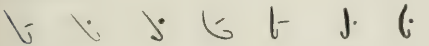
ugly, agree, only, table, robber, shuffle,



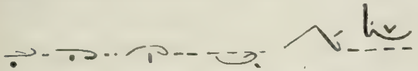
mover, leisure, dear, tell, till, more, call.

Final Hooks.

F and N Hooks. — A small final hook on any straight stem, if on the *l*-hook side, represents either *f* or *v*, and if on the *r*-hook side, represents *n*. A small final hook on the inner side of *any* curved stem also represents *n*. In phrase writing a large hook is used on curved stems for *f* or *v*. Examples. —

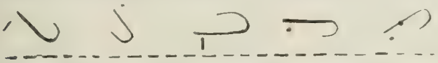


puff, pave, pain, fun, dove, den, then,

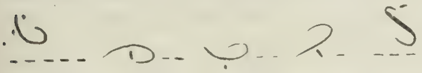


cave, cane, moan, noon, rebuff, divine.

Shun and Ter Hooks. — A large final hook on any straight stem, in place of the *f*-hook, represents the syllable *shun* or *zhun* (-tion, -sion, -cean, -cian, -sian, etc.); and in place of the *n*-hook, *ter* or *ther* (-ter, -tor, -ture, -ther). A large final hook, in place of the *n*-hook, on any curved stem, also represents *shun* or *zhun*. Examples: —



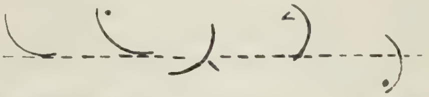
option, patter, caution, gather, rather,



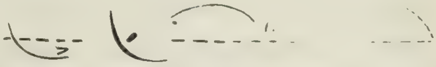
fashion, motion, notion, Russian, blotter.

Modified Stems.

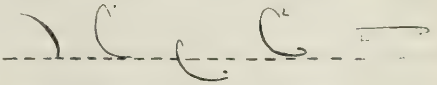
Doubling the length of any curved stem, whether simple or hooked, and of any straight stem *with a final hook*, adds either *ter*, *der*, or *ther*. The positions of lengthened upright or slanting stems are as follows: If written downward: *first* position, resting on the line; *second* position, divided by the line into halves; *third* position, three quarters below the line. If written upward: *first* position, half the length of a *tee* above the line; *second* position, on the line; *third* position, one quarter of the stem below the line. The positions of all horizontal stems, whether hooked or modified, are the same as for simple stems. Examples: —



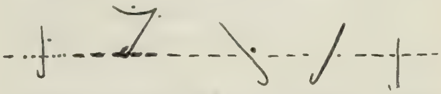
after, father, shutter, oyster, Easter,



future, voter, matter, latter, Arthur,

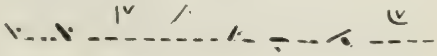


water, flatter, fritter, flounder, counter,

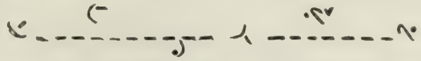


tender, enchanter, painter, gender, tinder.

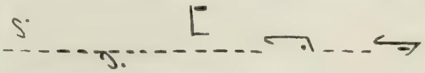
Either *t* or *d* may be added, by halving, to any consonant stem, whether simple or hooked. The positions of half-length upright or slanting stems are as follows: *first* position, above the line half the length of a *tee; second* position, on the line; *third* position, just below the line. Illustrations: —



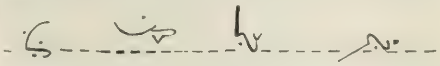
pet, bed, tight, chat, jet, get, wrote, fight,



vote, thought, east, shut, applied, prate,



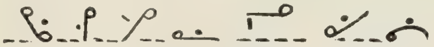
plant, print, talked, crept, clutched,



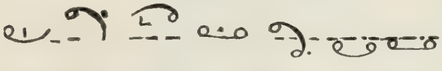
elegant, inclined, deprived, reprieved.

CIRCLES AND LOOPS.

Either *s* or *z* may be added to either end of any stem by a small circle. On straight stems it is written on the same side as the *l* and *f* hooks, and takes their place; on curved stems it is written on the inner side. Examples:—

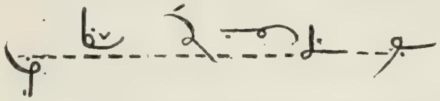


space, set, such, sake, cause, Sarah, same,

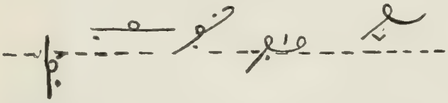


son, sway, house, sex, Swiss, since, six.

Between a straight and a curved stem the circle is written on the inner side of the curve. Otherwise, when it occurs between stems that form an angle, it is turned on the outer side of the angle, without regard to which side of a stem it is on. Examples:—

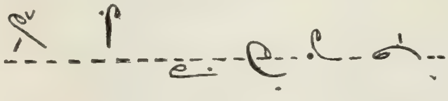


visit, design, wasp, chasm, desk, risk,

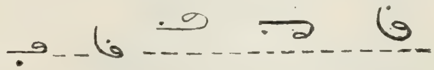


Tuesday, cask, reserve, reasons, resign.

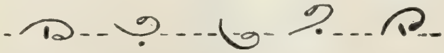
The circle may be joined to any hook by turning it inside its point. When so written, it is better not to make it perfectly round, but to elongate it into an ellipse, extending back on the hook. Examples:—



supply, saddle, sickle, civil, safer, summer,

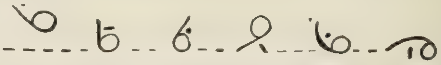


caves, fence, actions, gathers, fashions,

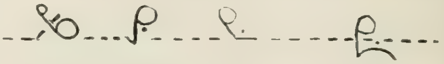


motions, nations, visions, rations, lotions.

When two *s* or *z* sounds come together, a large circle is used; thus:—

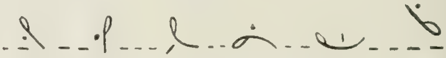


passes, doses, chases, roses, vases, Moses,

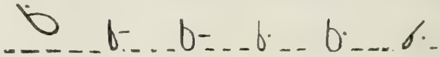


supposes, sustain, suspect, system.

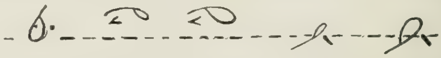
A small loop at either end of any stem, on the same side as the *s*-circle, and extending about one third the length of the stem, represents either *st* or *zd*. A large loop, similarly placed, extending about two thirds the length of the stem, represents *str*. The large loop is not used at the beginning of word outlines. Examples:—



step, state, stuff, stem, stung, past,

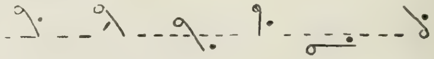


pastor, dust, duster, test, tester, chest,

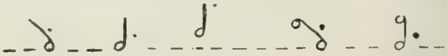


Chester, moist, moister, roost, rooster.

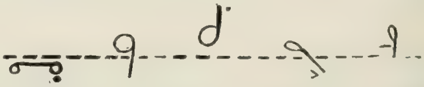
By writing the circles and loops on straight stems on the side and in place of the *r* and *n* hooks, the hook, or the sound it represents, is implied, though not written. These are called, respectively, *sper* and *pens* signs. Examples:—



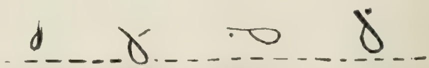
spray, supper, spree, stray, seeker, pains,



pence, dense, dance, sprains, strains,

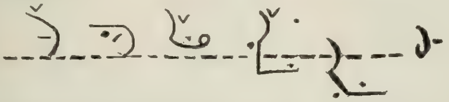


screens, sister, dances, stupor, strode,

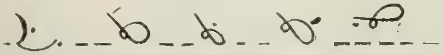


danced, punster, canister, banister.

The circle is not generally employed when *s* or *z* comes next to two concurrent vowels, and it is never used for *z* at the beginning of words. It is added finally to a large circle, to a loop, or to a curl, by continuing the stroke to the other side of the stem. Examples: —

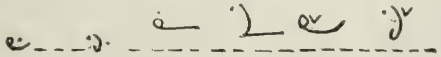


pious, chaos, science, sciatic, xebec, zone,

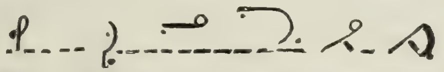


zany, possesses, pests, posters, castors.

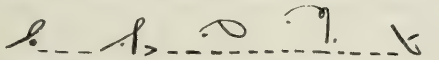
If a word begins with a vowel followed by *s*, the circle or loop cannot be used; and if the word ends with a vowel, immediately preceded by a consonant that is usually represented by the circles, loops, hooks, or modifications, such forms cannot be employed, but in both cases the regular stem forms must be used. The reason is that otherwise no place is provided beside a stem for the vowel sign. Examples: —



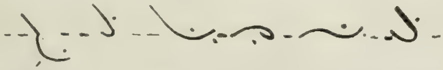
sent, ascent, sack, ask, sign, assign,



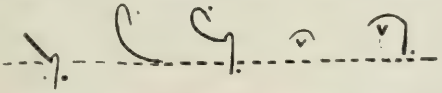
state, estate, gas, gassy, rose, rosy,



raised, residue, master, mastery, puff,



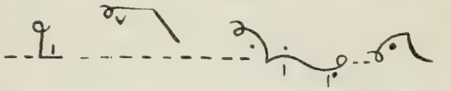
puffy, pen, penny, men, many, better,



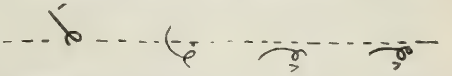
betray, flatter, flattery, might, mighty.

Curls.

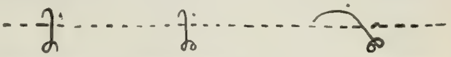
Before any *sper* sign, and before the simple stems *lee*, *er*, or *em*, the syllables *in*, *un*, and *en* may be added by an initial curl; and after a final *s*-circle, the syllable *shun* or *zhun* may be added by a final curl. Examples: —



instruct, inscribe, unceremonious, enslave,

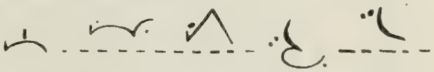


possession, physician, musician, musicians,

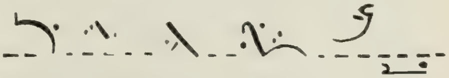


transition, transitions, impositions.

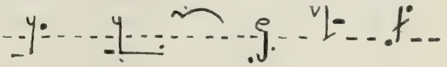
Brief Signs for W, Y, and H.—Besides the alphabetic signs for these sounds, they are provided with briefer signs, which may be employed when they give any special advantage of outline. *H* is written sometimes with a tick, and sometimes with a dot placed by the side of the vowel. *W* and *y* are written with a small semicircle, opening either to the right or the left for the former, and either up or down for the latter. The nominal consonant is a cancelled stem, for use with words that contain only vowel sounds. Examples: —



home, hamlet, harp, heavenly, halve,



whey, habit, hub, Abraham, wash, week,



Utah, Utica, yam, Sweden, Io, Eah.

The phonographic period is a small cross. This is also used to mark emphasis. Capital letters are indicated by writing two short parallel ticks under them. The dash is written with two parallel lines.

Abbreviations.

While most words are written phonographically with full outlines, in accordance with the principles already explained, yet there are quite a number of words whose outlines are shortened, so that greater speed is attained without loss of legibility. Some of these are thus abbreviated in accordance with rules that cover whole classes of words, and others are specially contracted.

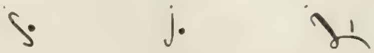
Prefixes. — The prefixes, which are generally disjoined, are written or indicated as follows: 1. *Com*, *con*, *cog*, and *cum*, by a light dot. 2. *For*, *fore*, by *ef*, joined or disjoined. 3. *Magna*, *magne*, *magni*, by *em*, written partially over the remainder of the outline. 4. *Self*, by the *s*-circle, written invariably on the line, and sometimes joined. 5. *With*, by *thee* joined.

Suffixes. — The suffixes are written or indicated as follows: 1. *Ble*, *bly*, by *bee* joined. 2. *Bleness*, *fulness*, *iveness*, and *lessness*, respectively, by *bee*, *ef*, *vee*, with final *s*-circle to each. 3. *Ever*, by the *v*-hook. 4. *Form*, by *ef*, joined or disjoined. 5. *Ing* and *ings*, respectively, by a light dot and the *s*-circle disjoined. 6. *Mental*, *mentality*, by disjoined half-length *em* with *n*-hook. 7. *Ology*, by *jay*, joined or disjoined. 8. *Self*, by *s*-circle joined. 9. *Selves*, by large circle joined. 10. *Ship*, by *ish*, joined or disjoined. 11. *Soever*, by *s*-circle and *vee* joined. 12. *With*, by *ith* or *thee* joined. 13. *Worthy*, by *thee*, joined or disjoined.

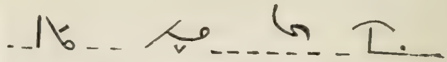
Remarks. — The *com*, etc., dot may be omitted and the syllable indicated by proximity; and occasionally the two parts of the outline are joined.

The signs of slightly enunciated consonants are often omitted, and hooks are left out in order to secure better joinings.

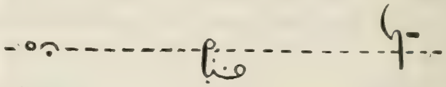
Of is frequently omitted, and merely indicated by writing the two adjacent words close together. So *to* and *too* are indicated by dropping the outline of the next succeeding word or phrase to the fourth position; that is, dropping it one half the length of a *tee* below what would be the third position of the same outline. Illustrations: —



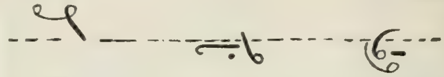
complain, contain, cumbersome,



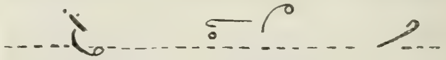
decompose, recognize, forward, magnetic,



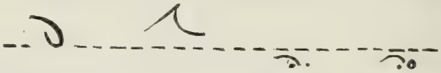
self-made, self-defence, withdraw,



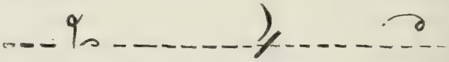
sensible-y, agreeableness, usefulness,



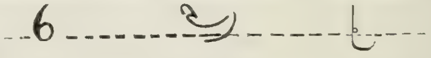
combativeness, carelessness, wherever,



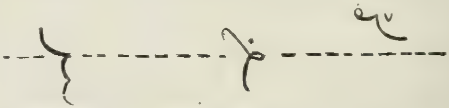
whenever, reform, meeting, meetings,



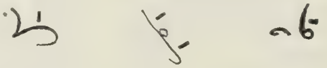
instrumental-ity, zoölogy, myself,



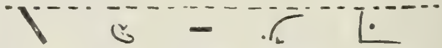
themselves, partnership, whatsoever,



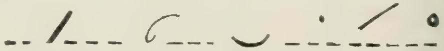
forthwith, praiseworthy, sanctify,



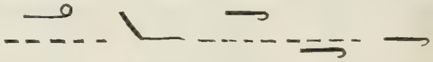
assumption, postpone, heard of those,



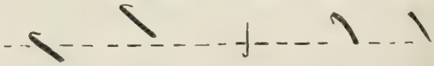
to be, to find, to get, to allow, to take.



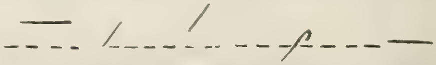
advantage, already, among, an-d, are, as,



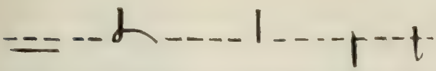
because, become, began, begin, begun,

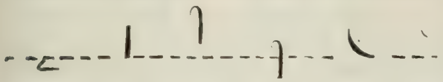


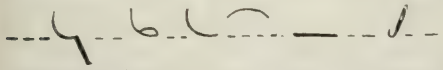
belief-ve, belong, between, brother, but,

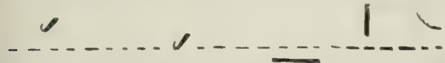


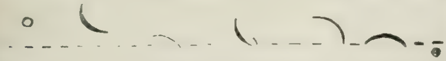
can, change, charge, children, come,

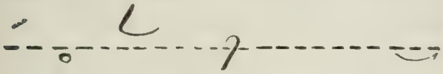

could, December, defendant, did, differ,

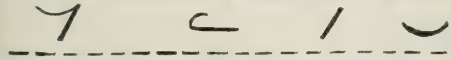

difficulty, do, doctor, during, ever, fact,

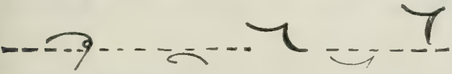

February, first, for, from, gave, general-ly,

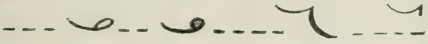

gentleman, gentlemen, give-n, had, half,

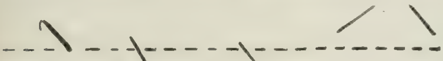

has, have, hear, Heaven, her, him, his,

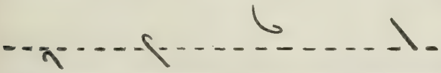

I, is, January, Jr. (junior), knew,

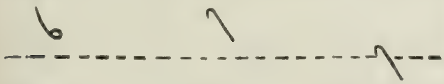

knowledge, language, large, long,

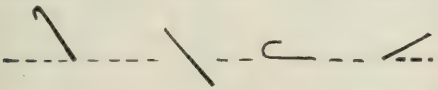

Massachusetts, Mr., never, new, New

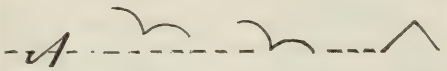

York, next, no sir, November, now,

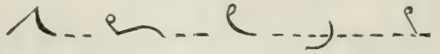

number, opinion, opportunity, our, part,

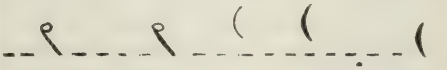

particular, people, phonography, plaintiff,

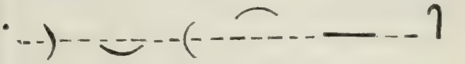

possible-y, practice, principal-le,

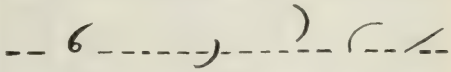

probable-y, public-sh, question, recollect,

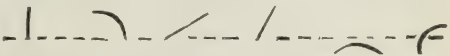

religion, remark, remember, represent,

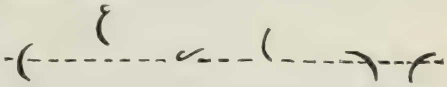

Rev., September, several, should, spoke,

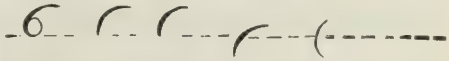

special-ly, subject, thank, that, the, them,


these, thing, think, time, together, truth,


United States, usual-ly, was, well, were,

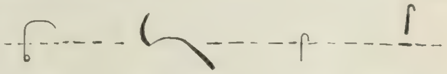

what, when, where, which, whom, will,

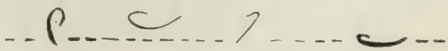

with, without, world, worth, would, year,

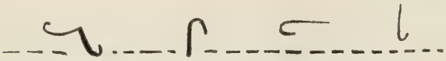

yes sir, yet, young, your, youth.

PHRASEOGRAPHY.

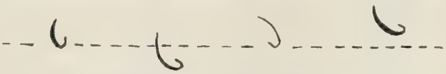
ALL of the phonographic material that has now been presented is not only used to write single words, but is also used to write groups of two or more words without taking the pen from the paper. This mode of writing is called *Phraseography*, and most of its principles are exemplified in the following illustrations: —


it was, they may be, it will, at all,

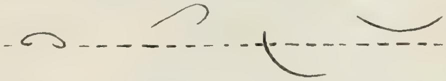

they will, on all, which are, among our,



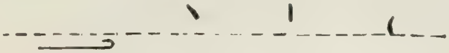
on or before, do we, can you, out of,



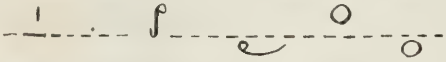
they have, if an, her own, have been,



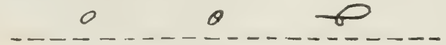
more than, are there, if there, on their,



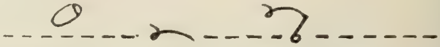
could have there, by it, at the, they had,



ought to, has done, is in, as his, is as,



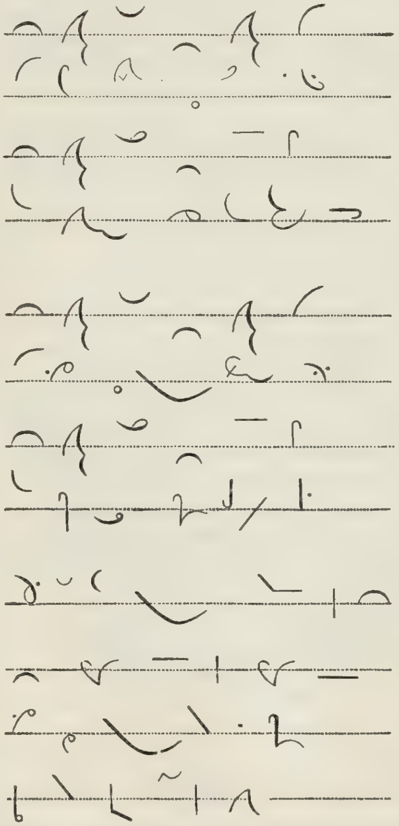
as the *or* as to, as it is, because there is,



as there is, in some, in as much as.

It is important that the learner should pay particular attention to the proper vocalization of phonographic outlines, and it is well to continue the practice of writing in all of the vowels, even after considerable proficiency in writing has been attained; for although the reporter seldom vocalizes, it is necessary when a vowel sign is to be inserted that he be able to do it both quickly and correctly.

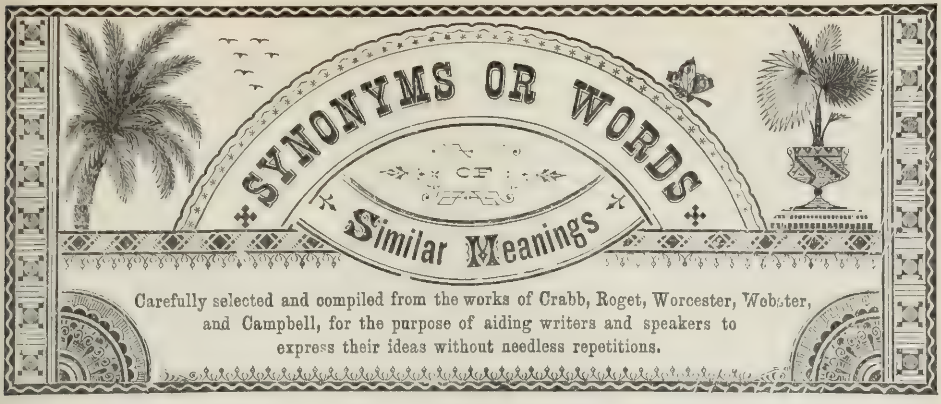
The foregoing article gives a very complete epitome of practical phonography, and if mastered will enable one to correspond in short-hand. But those who wish to pursue the study further, and to perfect themselves in this fascinating and most useful art, are referred to the works of Mr. James E. Munson (Tribune Building), New York.



He liveth long who liveth well!
All other life is short and vain:
He liveth longest who can tell
Of living most for heavenly gain.

He liveth long who liveth well!
All else is being flung away:
He liveth longest who can tell
Of true things truly done each day.

Waste not thy being; back to Him
Who freely gave it, freely give;
Else is that being but a dream:
'Tis but to be, and not to live.



SYNONYMS OR WORDS OF Similar Meanings

Carefully selected and compiled from the works of Crabb, Roget, Worcester, Webster, and Campbell, for the purpose of aiding writers and speakers to express their ideas without needless repetitions.

ABANDON, forsake, desert, relinquish, resign, renounce.
Abase, humble, degrade, disgrace, humiliate.
Abash, confuse, confound.
Abate, lessen, decrease, diminish.
Abbreviate, abridge, shorten, reduce.
Abdicate, relinquish, resign, vacate.
Abdomen, belly, paunch.
Aberration, wandering, deviation, divergence, rambling, illusion, hallucination, insanity, madness, lunacy.
Abettor, accomplice, accessory, *particeps criminis.*
Abhor, loathe, detest, abominate.
Abide, dwell, live, inhabit, sojourn.
Ability, capacity, talent, faculty, dexterity, address.
Abject, degraded, grovelling, low.
Abjure, recant, revoke, retract, recall.
Able, strong, powerful, capable, competent, qualified.
Abolish, abrogate, annul, repeal, revoke, cancel.
Abominable, detestable, execrable.
Aboriginal, primeval, native, first, original.
Abound, be plentiful, teem.
About, concerning, regarding, nearly, almost, near.
Abridge, abbreviate, curtail, contract.
Abridgment, summary, abstract, compendium, digest.
Abrogate, repeal, abolish, annul, revoke.
Abrupt, rugged, rough, hasty, harsh.
Abscond, steal away.
Absent, gone.
Absolute, arbitrary, despotic, tyrannical.
Absolve, loose, liberate, clear, forgive, acquit.
Absorb, imbibe, swallow, engross.
Abstain, forbear, refrain
Abstemious, temperate, sober.
Abstract, *n.* see ABRIDGMENT.
Abstract, *v.* separate, distinguish.
Abstruse, hidden, intricate.
Absurd, foolish, silly, ridiculous.
Abundance, sufficiency, plenty.
Abuse, misuse, upbraid, vilify, insult, pervert.
Abyss, gulf, gorge, pit.
Accede, assent, consent, comply, concur.
Accelerate, hasten, quicken, hurry.
Acceptable, agreeable, pleasing, welcome.
Accident, casualty, mishap, contingency, chance.
Acclamation, applause, plaudit.
Accommodate, fit, adapt, oblige, favor.
Accompany, attend, escort.
Accomplice, abettor, accessory.
Accomplish, execute, effect, achieve, perfect, fulfil.
Accord, concede, admit, allow, grant.
Accost, address, salute, greet, hail.
Account, narrative, description, reckoning, bill; reckon, explain.
Accoutre, fit out, equip.
Accumulate, amass, collect, gather.
Accurate, exact, precise.
Accuse charge, impeach, arraign, censure.
Accustom, habituate, inure.
Acerbity, sourness, tartness, asperity, acrimony.
Ache, pain, pang.
Achieve, do, accomplish, perform, effect, execute, gain, win, attain, finish, fulfil.
Acknowledge, own, confess, avow.
Acquaint, inform, tell, apprise.
Acquaintance, familiarity, intimacy.
Acquiesce, agree, consent, concur, yield.
Acquire, gain, obtain, win, earn.
Acquirement, acquisition.
Acquit, absolve.
Acrimony, acerbity, asperity, ill-temper.
Action, deed, gesture, posture, agency.
Active, diligent, industrious, assiduous, agile, nimble, officious.
Actor, agent, player, performer.
Actual, real, positive.
Actuate, induce, impel.
Acute, shrewd, keen.
Adage, saying, proverb.
Add, join, mix.
Addict, devote, apply.
Address, skill, speech, harangue, oration; apply, accost.
Adduce, advance, allege, cite, assign.
Adequate, sufficient, commensurate, able.
Adhere, attach.
Adieu, leave-taking, parting salutation.
Adjacent, contiguous, adjoining.
Adjourn, defer, postpone, prorogue.
Adjust, adapt, accommodate, settle, regulate.
Administer, give, furnish, serve.
Admirable, excellent, pleasing.
Admit, give, allow, permit, acknowledge, suffer.
Admonish, advise.
Admonition, warning, caution.
Adore, worship, idolize, venerate, revere.
Adorn, beautify, embellish, decorate.
Adulate, flatter, compliment.
Adulterated, impure, vitiated, deteriorated.
Advance, proceed.
Advantage, benefit, gain, utility.
Adverse, hostile, inimical, repugnant, averse.
Adversity, misfortune, distress.
Advice, counsel, instruction.
Advise, inform, counsel.

Advocate, counsel, defender; propose, maintain.
Aerial, airy, light, ethereal.
Affable, courteous, polite.
Affair, matter, business, concern.
Affect, influence, concern, pretend, assume.
Affectionate, loving, fond, kind.
Affirm, asseverate, assure, aver, vouch
Affix, attach, annex, subjoin.
Afflict, distress, trouble, torment.
Affluence, wealth, riches.
Afford, yield, produce, spare, confer.
Affront, *n.* indignity, insult, outrage.
Afraid, fearful, timorous, timid.
Afterward, afterwards, thereafter, subsequently.
Age, era, epoch, period.
Agitation, trepidation, emotion.
Agonize, pain, torture, torment, rack, distress.
Agreement, compact, bargain, contract, covenant.
Aim, point, level, object, view; aspire
Air, mien, look, manner.
Alarm, fright, terror, consternation.
Alertness, alacrity.
Alike, similar, same, identical.
Alive, living, existing.
All, each, every, whole.
Allay, assuage, soothe.
Allege, say, declare, affirm, assert.
Alleviate, relieve.
Alliance, union, affinity.
Allot, appoint, destine.
Allow, tolerate, grant, bestow.
Allowance, stipend, wages, salary, pay.
Allude, hint, suggest, refer.
Allure, tempt, seduce, decoy, entice.
Ally, confederate.
Alone, solitary, lonely.
Altercation, quarrel, dispute.
Although, though, yet, but, still.
Altitude, height, elevation.
Altogether, totally, wholly, entirely.
Always, ever, continually.
Ambiguous, equivocal, obscure.
Amend, mend, better, correct, improve.
Amiable, lovely, pleasing, beloved.
Amicable, friendly.
Amount, sum, aggregate, total.
Ample, spacious, capacious.
Amplify, enlarge, dilate.
Amuse, entertain, please, divert, beguile
Anger, wrath, ire, choler, rage, fury, indignation, resentment.
Animate, quicken, enliven, exhilarate, cheer.
Annals, records, history.
Annex, attach, affix, join.
Annihilate, destroy, extinguish, end, demolish.
Annotation, remark, commentary, note.
Announce, proclaim, publish.
Annoy, molest, disturb, worry.
Annul, repeal, cancel.
Anomalous, irregular, abnormal, exceptional.
Answer, reply, response, rejoinder.
Answerable, amenable, accountable, responsible.
Anterior, foregoing, preceding, antecedent
Anticipate, prejudge, expect.
Antipathy, dislike, hatred, aversion.
Antithesis, contrast, opposition.
Anxiety, care, solicitude, uneasiness.
Apart, separately, privately, secretly.
Apartment, room, chamber, hall.
Apology, excuse, plea, defence.
Apparel, dress, attire, array.
Apparent, visible, obvious, evident, manifest.
Appearance, air, aspect.
Appease, allay, calm, pacify.
Appellation, name, title.
Appended, added, joined.
Appertaining, belonging, relating, concerning.
Applause, acclamation, praise.
Apply, use, employ, allot, devote, dedicate, engage.
Appoint, ordain, order, prescribe.
Appreciate, esteem, estimate, appraise.
Apprehend, seize, conceive, imagine, fear, dread.
Apprise, tell, inform, acquaint.
Approach, access, admittance.
Approbation, approval, praise.
Appropriate, fit, suitable; usurp, assume, arrogate.
Approve, commend, praise, sanction.
Apt, fit, fitting, becoming, meet.
Arbiter, judge, umpire, arbitrator.
Arbitrary, tyrannical, tyrannous.
Architect, contriver.
Ardent, fiery, fervent.
Arduous, difficult, hard, laborious
Argue, debate, dispute.
Aright, rightly, properly, justly.
Arise, rise, issue, spring, flow, emanate, mount, climb.
Aromatic, fragrant, perfumed.
Arouse, excite, animate, stimulate
Arrange, adjust, assort, classify.
Arrant, notorious, consummate.
Array, order, disposition, display.
Arrest, take, seize, hold, detain.
Arrogance, presumption.
Art, skill, cunning, deceit.
Artificial, artful, fictitious.
Artless, simple, open, honest.
Ascertain, find out, learn.
Ascribe, attribute, impute.
Ask, request, solicit, entreat, beg, demand, inquire.
Aspect, look, appearance, view.
Asperse, calumniate, defame, slander, detract.
Aspiration, wish, desire, hope.
Assemble, muster, collect, convoke, convene.
Assent, consent, concurrence, approbation.
Assert, vindicate, maintain.
Assets, goods, effects, proceeds.
Assiduous, attentive, diligent, persevering.
Assign, transfer, convey, grant.
Assist, help, aid, succor, relieve.
Assorted, separated, classified.
Assuage, soften, mitigate, allay.
Assume, arrogate, usurp, claim.
Assurance, confidence, impudence.
Astonish, amaze, surprise, astound.
Astute, sagacious, shrewd, sharp.
Athletic, strong, vigorous, stalwart.
Atom, particle, molecule, speck.
Atrocious, wicked, cruel, heinous, villanous.
Attachment, inclination, affection.
Attack, assail, assault, encounter.
Attain, achieve, accomplish, acquire, get, procure, earn, win.
Attempt, effort, undertaking.
Attend, wait on, listen, mind, heed.
Attention, application, study.
Attest, certify, prove, affirm.
Attire, dress, apparel.
Attitude, position, standing.
Attract, allure, charm.
Attribute, quality, characteristic.
Audacious, bold, insolent.
August, grand, majestic.
Auspicious, fortunate, propitious.
Austere, severe, rigid, rigorous, stern.
Authentic, genuine, real, trustworthy.
Authorize, empower, direct.
Auxiliary, helping, assisting.
Avail, profit, help, benefit.
Avarice, covetousness, cupidity.
Avaricious, miserly, parsimonious, niggardly.
Average, medium, middle, mediocre.
Averse, unwilling, reluctant, backward
Aversion, antipathy, dislike, hatred, repugnance.
Avocation, business, vocation, occupation.
Avoid, shun, eschew, elude.
Avow, declare, aver, own, acknowledge, confess, admit, profess.

Awaken, arouse, excite, provoke.
Award, give, decree, order, adjudge, determine, assign.
Aware, conscious, apprised.
Awful, dreadful, fearful
Awkward, clumsy, uncouth, unhandy, froward, perverse.
Axiom, maxim, aphorism, proverb, adage

Backward, adverse, unwilling, reluctant, loath, disinclined.
Bad, evil, wicked.
Balance, poise, weigh, adjust.
Baneful, hurtful, ruinous.
Banishment, expulsion, exile.
Banquet, feast, carousal.
Banter, raillery, ridicule, badinage.
Barbarous, savage, brutal, uncivilized, outlandish, cruel, inhuman, ferocious, merciless.
Bare, naked, uncovered, scanty, destitute, mere.
Barren, unfruitful, sterile, unproductive, arid
Base, mean, vile.
Bashful, modest, diffident, retiring, shy, reserved.
Basis, base, foundation, footing, groundwork, support.
Battle, fight, engagement, combat, action.
Beach, shore, coast, strand, seaboard, sea-coast, seaside.
Bear, uphold, convey, transport, suffer, endure.
Bearing, manner, carriage, deportment, demeanor, mien, port, conduct, behavior.
Beastly, brutal, bestial, brutish, irrational, sensual, degrading.
Beat, strike, hit, overcome, defeat, conquer.
Beautiful, handsome, fine, pretty.
Becoming, fit, seemly, comely, grateful, decent
Beg, entreat, ask, beseech, crave, implore, supplicate, desire.
Begin, commence
Behavior, conduct, deportment, demeanor.
Belief, faith, trust, credit.
Below, beneath, lower.
Benefaction, donation, alms.
Beneficent, generous, bountiful, liberal.
Benefit, favor, kindness, civility, service.
Benign, kind, benevolent, gracious.
Bent, inclination, prepossession, turn; crooked, awry.
Bereave, deprive, strip.
Beseech, implore, entreat, crave.
Bestow, give, grant, present.
Better, improve, ameliorate, reform.
Bewail, lament, bemoan.
Bewilder, confuse, puzzle, mystify.
Bewitch, charm, fascinate, entrance.
Bias, prepossession, prejudice.
Bickering, dispute, wrangle, altercation.
Bid, offer, tender, order, command, direct.
Big, large, great, huge, bulky.
Bigoted, prejudiced, intolerant, narrow-minded.
Bill, account, reckoning; beak, jaw.
Bind, oblige, engage.
Binding, obligatory, restraining; astringent, constipating.
Birth, nativity.
Bitter, acrid, pungent, severe, acrimonious.
Black, dark, murky, pitchy.
Blame, censure, reprove, condemn.
Bland, mild, courteous, affable.
Blast, blight, destroy, wither; gust, squall, gale.
Blatant, noisy, bellowing, braying
Blemish, stain, flaw, spot, defect.
Blind, sightless, ignorant.
Blithe, merry, gay, vivacious.
Blockhead, dunce, simpleton, ignoramus.
Blot, stain, spot, blur, stigma.
Blow, stroke, calamity.
Bluff, brusque, rough.
Blunder, mistake, error.
Blunt, pointless, obtuse, coarse.
Boast, brag, vaunt
Bodily, corporal, corporeal, material
Boisterous, noisy, turbulent.
Bold, intrepid, dauntless, fearless.
Bondage, slavery, servitude, imprisonment.
Boorish, rude, clownish, awkward.
Booty, plunder, pillage, spoils.
Border, edge, verge, brink, margin, boundary
Bore, perforate, penetrate, weary.
Bother, vex, plague, tease, annoy.
Bottom, basis, foundation, groundwork.
Boundless, unbounded, unlimited, infinite.
Bountiful, liberal, munificent, abundant.
Bower, shady recess, arbor, retreat, alcove.
Branch, bough, limb, shoot, offshoot.
Brand, stigmatize, mark
Bravado, boasting, bragging, bluster.
Brave, courageous, gallant; defy, dare.
Brawny, muscular, strong, athletic.
Break, rend, tear, bruise, crush.
Breed, engender, produce; race, lineage
Brevity, shortness, conciseness, terseness.
Brief, short, concise, succinct, terse, curt.
Bright, lustrous.
Brilliancy, splendor.
Bring, fetch, bear, carry, produce.
Brisk, lively, active, quick.
Brittle, fragile, frail, frangible.
Broad, wide, large, extensive.
Broil, tumult, affray, brawl.
Build, erect, construct.
Bulk, massiveness.
Buoyant, floating, light, cheerful, lively.
Burden, *v.* load, cumber, oppress.
Burial, interment, entombment.
Burlesque, droll, comic, ludicrous; parody, caricature.
Burning, consuming, ardent, glowing, fervent.
Burst, rend, split, explode, disrupt.
Bury, inter, entomb. hide, conceal.
Business, employment, vocation, occupation, trade, profession, office, duty.
Busy, diligent, occupied, engaged.
But, except, save, still, yet.

Cabal, junto, faction, combination, plot.
Cajole, flatter, delude, coax.
Calamitous, disastrous, ill fated, ill starred, fatal, hapless.
Calamity, disaster, misfortune, mishap.
Calculate, compute, reckon, count.
Called, named, termed, designated.
Calling, employment, business, vocation, occupation, trade, profession, pursuit.
Callous, hard, hardened, obdurate, unfeeling.
Calm, quiet, serene, placid, tranquil, composed.
Calumny, slander, aspersion, defamation, backbiting.
Cancel, obliterate, expunge, efface, erase, blot out, annul.
Candid, fair, sincere, frank, open, plain.
Canvass, examine, discuss, solicit.
Capable, able, competent, qualified.
Capacious, ample, spacious, extensive.
Capacity, ability, faculty, talents, magnitude.
Caprice, whim, freak, fancy, vagary.
Captious, critical, cynical, peevish, petulant, fretful, cross.
Captivate, charm, entrance, fascinate, subdue, overpower.

Capture, seizure, arrest, prize.
Care, anxiety, solicitude, concern, charge, management, attention.
Career, course, race, history.
Careful, thoughtful, provident, attentive, solicitous.
Careless, heedless, thoughtless, negligent.
Caress, fondle, embrace.
Cargo, load, lading, burden.
Caricature, burlesque, parody, farce.
Carnal, sensual, animal, worldly, impure, lustful.
Carol, warble, sing, chirp.
Carousal, revel, feast, banquet.
Carriage, walk, gait, bearing, behavior, conveyance.
Carry, convey, transport, support, sustain.
Case, occurrence, contingency, event, condition.
Cash, money, coin, specie.
Cast, throw, hurl, project, frame, mould.
Casual, accidental, fortuitous, contingent, unforeseen.
Casualty, accident, occurrence, misfortune.
Catalogue, list, index, schedule, inventory.
Catch, seize, grasp, clutch, arrest, secure.
Catching, infectious, contagious, pestilential.
Categorical, positive, peremptory.
Catholic, universal, general, tolerant.
Cause, motive, reason, incitement, inducement, suit, action; create, produce, effect.
Caution, care, prudence, vigilance, circumspection, advice.
Cavity, opening, aperture, orifice, fissure.
Cease, desist, stop, quit, discontinue, refrain.
Ceaseless, everlasting, incessant, constant, perpetual, endless.
Celebrate, commemorate, solemnize.
Celebrated, famous, distinguished, illustrious, eminent.
Celerity, swiftness, quickness, rapidity, haste.
Celestial, heavenly, angelic, seraphic, elysian.
Censure, blame, reproach, reprove, reprehend, condemn, scold, chide.
Ceremonious, formal, precise, prim.
Ceremony, rite, formality, display, solemnity.
Certain, sure, indubitable, infallible, fixed, positive, real.
Certify, testify, attest, declare, vouch.
Chafe, rub, gall, fret, irritate, vex.
Challenge, dare, defy, brave.
Champion, leader, chieftain, protector, defender.
Chance, accident, fortuity, hazard, casualty; venture, risk.
Change, alter, vary, deviate, barter, exchange; variation, alteration, variety; currency.
Chaplet, wreath, garland.
Character, quality, kind, class, reputation, record.
Characterize, style, designate, mark.
Charge, accuse, impeach, impute; care, custody, trust, cost, price, expense, onset, attack.
Charitable, kind, benevolent, forgiving, lenient, generous.
Charlatan, quack, pretender, impostor.
Charm, spell, allurement, fascination, attraction; enrapture, captivate, transport, entice.
Chase, pursue, hunt.
Chaste, pure, virtuous, undefiled.
Chasten, chastise, punish, discipline.
Chat talk, chatter, gossip.
Chattels, goods, movables, wares.
Cheap, inexpensive.
Cheat, deceive, dupe, swindle, defraud; imposture, artifice, trick.
Check, restrain, repress, hinder, obstruct, repulse, rebuff, setback; note, draft.
Cheer, comfort, enliven, encourage, animate.
Cheerless disconsolate, gloomy, dejected, melancholy.
Cherish, foster, nourish, protect
Chide, reprove, blame, admonish.
Chief, principal, leading, cardinal; commander.
Chimerical, fanciful, absurd, wild, quixotic.
Choice, select, rare, precious; election, selection, preference.
Choke, throttle, strangle.
Choler, anger, rage fury, ire.
Choose, select, elect, prefer.
Chronicle, register, record, annals, memoir.
Circuitous, tortuous, winding, indirect, devious.
Circulate, spread, disseminate, propagate.
Circumspect, cautious, wary, watchful, vigilant, prudent.
Circumstance, event, incident, situation, condition, fact.
Cite, quote, mention, name, call, summon.
Civil, courteous, polite, urbane, obliging.
Civilization, culture, refinement.
Claim, demand, ask, request.
Claim, pretension, title.
Clamor, outcry, uproar, tumult.
Clandestine, private, secret, underhand.
Class, grade, degree, species, genus.
Clause, stipulation, provision, article, condition.
Clean, cleansed, pure, clear, untarnished.
Clear, serene, unclouded, obvious, apparent, evident, manifest, distinct, plain, lucid, free, unobstructed; exonerate, absolve, acquit, relieve, release, set free, extricate.
Cleave, adhere, stick, cling, split, rend, part, divide.
Clemency, mercy, lenity, compassion.
Clever, skilful, ingenious, expert, talented
Climb, ascend, scale, mount, rise.
Close, dense, compact, near; enclose, shut, end, finish, terminate.
Clothes, garments, dress, apparel, garb, raiment, habiliments, costume.
Clumsy, awkward, unhandy, ungainly, uncouth, unwieldy.
Coalition, union, alliance, league, combination.
Coarse, rude, rough, gross, unrefined, indelicate, vulgar.
Coax, wheedle, flatter.
Coerce, compel, force, check, restrain.
Coincide, concur, acquiesce, assent, approve.
Cold, chill, frigid, unfeeling, stoical, apathetic.
Colleague, coadjutor, ally, associate.
Collect, gather, assemble, convene, accumulate, amass.
Collected, calm, cool, composed, serene
Collision, clash, concussion, encounter, conflict.
Colossal, gigantic, enormous, huge, immense, titanic.
Color, hue, tint, complexion, pretence.
Combination, alliance, league, union, coalition, cabal.
Comely, graceful, agreeable.
Comfort, console, solace, cheer, encourage.
Comfortable, pleasant, agreeable, cosy.
Comfortless, cheerless, wretched, disconsolate, forlorn.
Comic, funny, ludicrous, laughable, droll.
Command, order, charge, direct, enjoin; mandate, decree, behest, precept.

Commanding, authoritative, imperative, imperious.
Commence, begin, undertake.
Commend, praise, applaud, laud, extol; approve, recommend.
Comment, note, remark, annotation, observation.
Commit, intrust, confide, do, perpetrate.
Commodious, convenient, large, spacious.
Common, usual, general, frequent; low, mean, vulgar.
Commotion, agitation, tumult, turmoil, disturbance.
Communicate, reveal, disclose, divulge, announce.
Communion, fellowship, converse, association, union
Community, society, association.
Commute, exchange, barter, alter, mitigate.
Compact, close, dense, solid; contract, agreement.
Company, association, society, fraternity, assemblage, firm, posse
Comparison, similitude, simile, illustration.
Compassion, sympathy, pity, commiseration, tenderness.
Compel, oblige, force, coerce.
Compensate, pay, remunerate, recompense.
Compete, cope, emulate, contend.
Competent, fitted, capable, able, efficient.
Competitor, rival, antagonist, opponent.
Complain, find fault, murmur, grumble.
Complete, finished, perfect, full, entire; effect, execute, consummate, terminate, perfect.
Complex, complicated, intricate, tangled.
Compliment, flatter, praise, extol.
Comply, yield, submit, consent, obey.
Compose, construct, form, constitute, soothe, calm, allay, adjust, write.
Compound, mixture, combination.
Comprehend, include, comprise, embrace, embody, involve, understand, conceive, apprehend, grasp.
Comprehension, understanding, apprehension, conception.
Comprehensive, large, broad, wide.
Compress, condense, squeeze, reduce.
Comprise, include, contain.
Compromise, adjust, implicate, settle.
Compulsion, constraint, coercion, force, restraint.
Compunction, contrition, regret, penitence.
Compute, calculate, count, estimate, appraise.
Conceal, secrete, disguise, dissemble.
Concede, yield, admit, grant, allow.
Conceit, idea, notion, egotism, vanity.
Conception, idea, perception, apprehension, comprehension.
Concern, matter, affair, interest, solicitude, anxiety.
Concert, contrive, arrange, adjust, devise; concord, agreement, cooperation.
Conciliate, reconcile, propitiate.
Concise, short, brief, condensed, terse.
Conclusion, termination, result, close, inference, deduction, decision.
Conclusive, decisive, final, indisputable.
Concord, harmony, piece, unity, union.
Concur, coincide, acquiesce, approve.
Condemn, sentence, censure, denounce, blame.
Condense, compress, concentrate, epitomize, contract, reduce.
Condescend, deign, vouchsafe.
Condign, merited, deserved, adequate.
Condition, situation, predicament, stipulation, proviso.
Condolence, commiseration, sympathy, compassion.
Conducive, promotive, tending, contributive.
Conduct, behavior, demeanor; lead, manage.
Confer, bestow, give, consult, discuss.
Confess, acknowledge, reveal, avow.
Confidence, trust, faith, reliance, belief.
Confident, positive, assured, sanguine, bold.
Confine, restrict, bound, limit, circumscribe, imprison.
Confirm, corroborate, substantiate, ratify.
Conflict, fight, contest, battle, encounter.
Conform, comply, yield, harmonize.
Confused, disordered, chaotic, perplexed, embarrassed, abashed.
Conjecture, surmise, supposition.
Connect, join, unite, couple.
Conquer, vanquish, overcome.
Conscientious, scrupulous, exact.
Conscious, aware, sensible.
Consent, assent, permission.
Consequence, importance, significance, result.
Considerate, thoughtful, prudent, reflective.
Consistent, agreeing, consonant, compatible.
Console, comfort, solace, soothe.
Conspicuous, prominent, noticeable.
Constant, continual, perpetual, faithful.
Construct, build, compose, invent.
Consume, destroy, burn, devour.
Consummate, perfect, finish, execute.
Contagious, catching, infectious.
Contain, hold, include, comprise.
Contaminate, defile, corrupt, sully.
Contemplate, ponder, consider, intend.
Contemptible, despicable, paltry, mean.
Contend, contest, compete, argue.
Content, satisfied, pleased.
Contingency, possibility, event, occurrence.
Continue, endure, remain, persevere.
Continuous, unbroken, uninterrupted, unintermitted.
Contradict, deny, refute, oppose.
Contribute, tend, assist, give.
Contrition, repentance, penitence, remorse.
Contrivance, device, scheme, design.
Convenient, adapted, handy, suitable.
Conversation, chat, discourse, conference.
Convey, take, bear, carry.
Conviction, satisfaction, detection, persuasion.
Convivial, sociable, agreeable.
Copious, ample, plenteous, exuberant, abundant.
Copy, model, duplicate; follow.
Cordial, hearty, stimulating.
Correct, rectify, amend, chastise.
Corroborate, strengthen, confirm.
Corruption, depravity, adulteration.
Cost, price, expense.
Counsel, advice; lawyer.
Countenance, face; sanction, support.
Counterfeit, feign; spurious.
Couple, connect, join; pair.
Courage, fearlessness, firmness, bravery.
Course, series, method, way, track.
Courteous, polite, respectful, affable.
Covenant, agreement, contract.
Covering, concealing, sheltering
Covetousness, greed, avarice.
Coward, poltroon, sneak.
Cowardice, timidity, fear.

Crafty, subtle, cunning, deceitful.
Crime, sin, guilt.
Crisis, critical point, juncture.
Criticism, judgment, review.
Crooked, deformed, curved.
Cross, splenetic, peevish, ill tempered.
Cruel, brutal, pitiless, inhuman, savage.
Cultivation, tillage, improvement, refinement.
Cure, restore, heal.
Curious, prying, inquisitive.
Curse, anathema, malediction, imprecation.
Cursory, superficial, careless.
Curtail, abridge, shorten, contract.
Custom, practice, habit, usage, manner.

Dainty, choice, delicate.
Damage, detriment, injury.
Dampness, humidity, moisture.
Danger, peril, risk.
Daring, brave, courageous, fearless.
Dark, dismal, gloomy.
Date, age, era, epoch.
Dead, deceased, inanimate, lifeless.
Deadly, fatal, mortal
Dealing, commerce, trade, traffic.
Debar, deter, exclude, prevent
Debase, degrade, disgrace, humble.
Debate, argue, dispute, wrangle.
Debilitate, enervate, weaken, enfeeble.
Debility, incapacity, feebleness, infirmity.
Decease, death, demise.
Deceit, cunning, fraud, duplicity, deception.
Decent, becoming, seemly.
Decide, determine, resolve, settle.
Decision, conclusion, determination, judgment.
Decisive, convincing, conclusive.
Declare, affirm, announce, assert, proclaim.
Decline, reject, repel, decay.
Decorate, adorn, ornament, embellish.
Decoy, seduce, allure, entice.
Decrease, abate, diminish, lessen.
Dedicate, consecrate, devote.
Deduction, conclusion, inference.
Deed, feat, action, exploit.
Deface, mutilate, destroy, disfigure.
Defame, vilify, slander, calumniate.
Defeat, frustrate, vanquish, conquer, overcome
Defect, blemish, flaw, imperfection.
Defence, vindication, justification, protection.
Defer, procrastinate, delay, postpone, retard.
Deference, veneration, submission, respect.
Deficient, imperfect.
Defile, pollute, vitiate, corrupt.
Definite, certain, precise, exact, positive.
Defraud, cheat, swindle, deceive.
Degrade, depreciate, disparage, disgrace.
Degree, class, station.
Delay, postpone, protract, prolong, hinder.
Deliberate, considerate, cautious, slow.
Delicate, dainty, elegant, fine, tender.
Delightful, charming, delicious, lovely.
Delineate, depict, describe, sketch, represent.
Delinquent, offender, criminal.
Deliver, transmit, rescue, surrender, save, utter, yield.
Delusion, deception, fallacy, illusion.
Demand, ask, claim.
Demolish, destroy.
Demonstrate, prove, evince, illustrate.
Denominate, style, name, designate.
Denote, signify, mark, imply.
Deny, contradict, oppose, refuse.
Departure, abandoning, forsaking, exit.
Dependence, confidence, trust, reliance.
Deplore, lament, bemoan, mourn.
Deportment, behavior, demeanor, conduct.
Depraved, profligate, wicked, corrupt, degraded.
Depreciate, degrade, detract, disparage, traduce.
Deprive, strip, divest, prevent
Deputy delegate, agent, representative.
Derange, confuse, disconcert, disorder.
Deride, mock, banter, ridicule.
Describe, represent, illustrate, delineate
Desert, forsake, abandon; solitary; wilderness.
Design, sketch, plan, purpose.
Designate, style, name, indicate.
Desist, cease, stop.
Desperate, despairing, regardless, careless, furious.
Despicable, contemptible, mean, pitiful.
Despotic, absolute, arbitrary,
Destination, appointment, point, fate.
Destitute, needy, poor.
Destroy, ruin, annihilate, consume.
Desultory, hasty, irregular.
Detach, sever, disjoin, separate
Detail, recital, account, narration.
Detain, hold, confine, restrain.
Detect, convict, discover
Determine, resolve, decide, settle, limit, fix.
Detest, abominate, abhor, loathe.
Detract, derogate, calumniate, defame, vilify, slander.
Detriment, prejudice, disadvantage, damage, injury.
Develop, exhibit, grow, unravel, unfold.
Deviate, swerve, digress, wander.
Device, invention, scheme, contrivance, plan.
Devote, dedicate, apply, consecrate.
Devout, prayerful, pious, religious.
Dexterity, tact, ability, skill.
Dialect, language, speech.
Dictate, instruct, direct, order.
Die, expire, perish, depart.
Differ, disagree, vary, dissent.
Different, diverse, various, unlike.
Difficult, troublesome, arduous, hard.
Difficulty, impediment, obstruction, trouble, embarrassment.
Diffident, hesitating, modest, bashful.
Dignified, stately.
Diligent, attentive, persevering, assiduous.
Diminish, subside, lessen, curtail, decrease.
Direct, show, guide, manage.
Direction, superscription, address, command.
Directly, immediately, instantaneously, promptly.
Disadvantage, detriment, injury, prejudice.
Disagree, differ, dissent.
Disappoint, defeat, balk.
Disaster, mishap, calamity, misfortune.
Discern, discover, penetrate, distinguish.
Disclose divulge, reveal.
Discord, dissension, contention.
Discover, disclose, reveal, impart, detect.
Discredit, reproach, scandal, dishonor, disrepute.
Discretion, judgment, prudence.
Disdain, haughtiness, scorn, contempt, arrogance.
Disease, sickness, malady, distemper.
Disgrace, degrade, dishonor.
Disguise, dissemble, cover.
Disgust, aversion, loathing, dislike.
Dishonor, disgrace, shame.
Dislike, antipathy, aversion, repugnance.

Dismiss, discard, discharge.
Disorder, irregularity, confusion, tumult, disease.
Disparage, depreciate, degrade, undervalue, detract.
Display, show, parade, ostentation.
Displease, vex, offend.
Dispose, regulate, arrange.
Dispute, controversy, altercation, contest.
Disseminate, propagate, circulate, spread
Dissertation, discourse, treatise, essay.
Dissipate, dispel, disperse, expend.
Distinct, different, separate, clear, dissimilar, obvious.
Distinguish, discern, discriminate.
Distinguished, illustrious, celebrated, eminent.
Distress, misery, affliction, suffering, anguish, sadness.
Distribute, divide, apportion, scatter
Diversion, deviation, amusement, recreation.
Divide, distribute, separate.
Divulge, disclose, communicate, reveal.
Docile, yielding, gentle, tractable, pliant.
Doctrine, precept, principle, dogma.
Dogmatical, positive, authoritative, arrogant.
Doubt, uncertainty, suspense, scruple.
Doubtful, equivocal, precarious, dubious.
Drag, draw, pull. haul.
Dreadful, fearful, terrible, awful.
Dress, attire, garments, apparel.
Droop, decline, pine, languish.
Dumb, inarticulate, mute.
Durable, lasting, permanent.
Dutiful, respectful, obedient.
Dwelling, residence, house, abode.
Dye, tinge, stain, color.

Eager, earnest, ardent, serious.
Earn, obtain, acquire, make.
Ease, facility, rest, repose, quiet.
Eccentric, odd.
Economical, frugal, saving, close.
Ecstasy, enthusiasm, transport, rapture.
Edifice, structure, building.
Education, tuition, refinement, instruction, cultivation, culture.
Efface, eradicate, expunge, erase, obliterate.
Effect, consequence, result.
Effects, property, goods, chattels.
Efficient, competent, able, capable.
Effort, trial, endeavor, exertion.
Elegant, handsome, graceful, beautiful.
Elevate, raise, lift, exalt, hoist.
Eligible, capable, suitable.
Emanate, flow, issue, proceed.
Embarrass, distress, perplex, entangle.
Embellish, beautify, ornament, decorate, illustrate.
Emblem, symbol, type, figure.
Embrace, contain, include, comprehend, comprise, clasp.
Emergency, casualty, exigency, necessity.
Emolument, reward, advantage.
Emotion, excitement, agitation.
Employment, occupation, business, profession, trade.
Empower, commission, authorize.
Empty, void, vacant, evacuated.
Encomium, praise, eulogy.
Encourage, countenance, instigate, animate.
Encroach, trespass, infringe, intrude.
End, purpose, termination, consequence, finish, extremity.
Endeavor, attempt, aim, effort.
Endless, eternal, infinite, unending, perpetual.
Endurance, fortitude, patience.
Enemy, foe, adversary, antagonist.
Energy, force, vigor, determination.
Engage, attract, employ, enlist, promise, fight.
Enjoyment, gratification, pleasure.
Enlarge, increase, extend, widen.
Enmity, animosity, malignity, hostility
Enough, abundance, ample, plenty, sufficient.
Enrage, exasperate, aggravate, incense.
Enrapture, enchant, fascinate, captivate.
Enterprise, undertaking, business, adventure.
Entertainment, feast, recreation, performance.
Entice, tempt, allure, seduce, decoy.
Entire, full, total, complete, whole.
Entitle, denominate, name, designate.
Entreat, supplicate, implore, beseech, crave.
Envy, jealousy, suspicion.
Epidemical, pestilential, catching, contagious.
Epitomize, condense, abridge.
Equal, uniform.
Erase, cancel expunge, obliterate.
Erect, raise, elevate, found, build, institute, construct.
Error, mistake, blunder.
Escape, avoid, elude, evade.
Essential, indispensable, requisite, necessary.
Esteem, respect, regard, appreciate.
Estimate, appreciate, appraise.
Eternal, immortal, infinite, endless, everlasting.
Eulogy, panegyric, encomium.
Evade, escape, shun, elude, avoid.
Even, equal, smooth, uniform.
Event, incident, adventure, occurrence
Ever, incessantly, always, continually.
Evidence, proof, testimony, deposition.
Evil, wicked, sinful.
Exact, extort, demand; precise, accurate.
Exalted, high, dignified, elevated, raised.
Examination, research, inquiry, investigation, scrutiny.
Example, pattern, copy, precedent.
Exceed, transcend, surpass, excel.
Excellence, eminence, superiority, goodness, purity.
Except, object; but, unless.
Exchange, trade, barter.
Excite, irritate, provoke, incite, stimulate.
Exculpate, justify, forgive, exonerate.
Excursion, trip, jaunt, tour.
Excuse, evasion, pretence, subterfuge, apology.
Execrable, detestable, abominable, contemptible.
Exemption, privilege, freedom, immunity.
Exercise, exert, practise, employ.
Exhaust, spend, empty, consume.
Exhilarate, inspire, enliven, animate, gladden.
Exigency, emergency, necessity, urgency.
Exonerate, exculpate, relieve, absolve, acquit, justify.
Expectation, anticipation, hope.
Expedient, requisite, necessary, suitable; device, resource.
Expedite, accelerate, facilitate, hasten.
Expel, banish, exile, eject.
Expensive, valuable, costly, extravagant.
Experience, knowledge, experiment, trial.
Expert, dexterous, skilful, adroit.
Explain, elucidate, expound, interpret.
Explanation, detail, description, exposition, illustration.
Explicit, express, plain, definite, positive.
Exploit, performance, achievement, feat.
Explore, search, examine, inspect.
Extend, diffuse, distend, increase, enlarge, lengthen.

Extenuate, palliate, lessen.
Exterior, external, outside, outward.
Exterminate, extirpate, eradicate, destroy.
External, exterior, outward, extraneous.
Extol, applaud, commend, praise.
Extravagant, prodigal, wasteful, lavish, irregular.

Fabricate, forge, frame, falsify.
Facetious, jocose, pleasant, witty, humorous.
Fact, circumstance, event, incident.
Faculty, power, ability, talent, gift, disposition.
Failing, fault, weakness, frailty, miscarriage.
Fair, just, impartial, equitable, clear.
Faith, trust, fidelity, belief.
Fallacious, fradulent, delusive, visionary.
Falsehood, untruth, lie, fabrication, fiction.
Familiar, intimate, free.
Famous, illustrious, distinguished, renowned.
Fanciful, hypochondriacal, whimsical, imaginative, capricious.
Fancy, ideality, inclination, conception, imagination, taste.
Far, remote distant.
Fascinate, enrapture, bewitch, captivate.
Fashion, style, mode, practice, custom, manner.
Fasten, attach, hold, annex.
Fastidious, disdainful, squeamish.
Fate, lot, destiny, doom, chance, fortune.
Fault, offence, failing, foible, blemish, error.
Favor, benefit, support, kindness.
Favorable, propitious, auspicious, friendly.
Fear, apprehension, dread, fright, terror.
Fearless, courageous, brave.
Feasible, practicable.
Feat, deed, exploit, act, trick.
Feeble, weak, infirm.
Feeling, emotion, passion, sentiment.
Felicity, blessedness, bliss, happiness.
Fertile, productive, fruitful, prolific.
Fervor, ardor, zeal.
Fetter, bind, shackle.
Fickle, unstable, changeable, inconstant, variable.
Fiction, fabrication, invention, untruth.
Fidelity, loyalty, honesty, faith, integrity.
Fiery, vehement, passionate, fervent, ardent, impulsive.
Figure, statue, shape, representation, semblance
Fine, delicate, showy, nice, lovely, pretty.
Finesse, stratagem, artifice.
Finish, perfect, complete, terminate, close.
First, commencement, primitive, primary, original, earliest, chief.
Fix, settle, limit, arrange, determine.
Flag, droop, decline, languish.
Flavor, odor, taste, fragrance.
Flaw, defect, blemish, stain, crack.
Flexible, pliant, pliable, ductile
Fluctuate, vacillate, hesitate, change, waver.
Follower, successor, adherent, pursuer, believer.
Fondness, affection, indulgence.
Forbear, refrain, abstain, spare.
Forbid, interdict, prohibit
Force, coerce, violence.
Forebode, betoken, foretell, augur, prognosticate, presage.
Forego, resign, quit.
Foregoing, anterior, before, antecedent, former, preceding, previous, prior.
Foreigner, alien, stranger.
Forethought, premeditation, anticipation, foresight.
Forfeiture, fine, penalty.
Forge, feign, invent.
Forgive, excuse, absolve, acquit, remit, pardon.
Forlorn, deserted, forsaken, destitute, lonely, lost.
Form, rite, ceremony, shape.
Formal, precise, ceremonious, particular, methodical.
Forsake, desert, abandon, leave.
Fortunate, prosperous, successful.
Forward, progressive, presumptuous, bold, eager.
Fragile, brittle, frail.
Frame, fabricate, plan, propose, contrive.
Fraternity, society, brotherhood, guild.
Freak, whim, humor, caprice.
Free, bounteous, unreserved, unconstrained, liberal; enfranchise, liberate.
Frequently, often, repeatedly.
Fresh, cool, new.
Fret, vex, chafe, agitate, gall.
Friendly, amicable, agreeable, kind.
Fright, panic, terror.
Frighten, daunt, terrify, scare, intimidate.
Frightful, fearful, horrid, dreadful, terrible.
Frivolous, trivial, futile, trifling.
Frugal, prudent, saving, economical.
Fruitful, prolific, productive, plentiful.
Frustrate, disappoint, defeat, foil, hinder.
Furious, boisterous, vehement, violent.

Gain, profit, obtain, acquire, get.
Gait, carriage, walk.
Gale, hurricane, tempest, storm.
Gallantry, courage, courtesy.
Gay, cheerful, dashing, showy, merry.
Generally, commonly, usually.
Generous, liberal, beneficent
Genius, taste, talent, wisdom, intellect, ability, ingenuity, capacity.
Genteel, cultured, polite. mannerly, polished, refined.
Gentle, peaceable, tame, quiet, mild, meek.
Genuine, natural, real, true, actual, unadulterated, unalloyed, authentic.
Germinate, vegetate, sprout, bud, grow, shoot.
Gesture, attitude, action, posture.
Get, possess, gain, acquire, attain, realize, procure, obtain.
Giddiness, levity, flightiness, volatility, lightness.
Gift, talent, donation, present.
Give, yield, impart, grant.
Glad, gratified, happy, joyous.
Glance, glimpse, sight.
Glitter, glisten, shine, sparkle.
Gloomy, morose, cloudy, dull, sullen.
Glory, splendor, fame, renown.
Graceful, neat, elegant. genteel.
Grand, sublime, superb. glorious, magnificent.
Grant, yield, give, sell, bestow.
Grasp, catch, seize, gripe
Grateful, pleasing, agreeable, thankful.
Gratification, fruition, indulgence, happiness.
Grave, thoughtful, sedate, solemn, serious.
Greediness, rapacity, voracity, ravenousness.
Grief, anguish, sorrow, distress.
Grieve, mourn, lament; hurt, afflict
Group, collection, cluster.
Grow, increase, sprout, become.
Guarantee, secure, vouch for, warrant.
Guard, protect, shield, defend.
Guess, surmise, conjecture.
Guest, visitor, stranger.
Guide, regulate, lead, direct, conduct.
Guilty, sinful, wicked.

Habit, guise, custom.
Hale, strong, sound, robust.
Handsome, noble, beautiful, elegant.
Happiness, bliss, contentment, felicity.
Harass, torment, molest, disturb.
Harbinger, precursor, messenger.
Hard, close, firm, difficult, inexorable, arduous.
Hardihood, daring, presumption, audacity.
Hardly, scarcely, barely.
Harm, injury, misfortune, damage.
Harmless, innocent, inoffensive, unoffending.
Harmony, accordance, melody, unison, concord.
Harsh, morose, stern, severe.
Haste, precipitancy, despatch, hurry.
Hasten, quicken, accelerate, expedite.
Hasty, passionate, rash, cursory, quick.
Hate, abominate, loathe, detest.
Hateful, loathsome, odious, execrable.
Haughtiness, vanity, arrogance, self-conceit.
Hazard, peril, danger, venture.
Headstrong, venturesome, violent, stubborn, obstinate.
Heal, remedy, cure.
Healthy, salubrious, wholesome, sound.
Hear, hearken, attend, listen.
Hearty, healthy, sincere, cordial.
Heaviness, gravity, gloom, dejection.
Heedless, inattentive, careless, negligent.
Heighten, raise, improve.
Heinous, atrocious, flagrant.
Help, succor, support, relieve.
Hence, consequently, accordingly, thence, therefore.
Heroic, courageous, noble, fearless, valiant.
Heroism, fortitude, gallantry, bravery, courage.
Hesitate, stammer, pause, falter.
Hidden, concealed, mysterious, covert.
Hideous, awful, ghastly, horrible.
High, lofty, tall.
Hilarity, gayety, jollity, joviality, merriment.
Hinder, retard, impede, obstruct, prevent, thwart.
Hold, possess, keep, grasp, detain, contain.
Hollow, vacant, empty.
Honesty, uprightness, probity, integrity, fidelity.
Honor, reverence, venerate, dignify, respect, revere.
Hope, anticipation, expectation, confidence, trust.
Hopeless, despairing, dejected.
Horrible, terrible, frightful, awful.
Hostile, repugnant, unfriendly, warlike.
Hostility, animosity, opposition, enmity.
House, domicile, dwelling, family, race.
However, still, notwithstanding, yet.
Huge, immense, enormous.
Humanity, compassion, benignity, benevolence.
Humble, unassuming, meek, submissive, modest.
Hurry, precipitate, expedite, hasten.
Hypocrisy, deceit, pretence.

Idea, perception, imagination, conception.
Idle, unoccupied, unemployed, inactive, indolent, at leisure.
Ignorant, illiterate, unlearned, unskilled, uninformed.
Illness, sickness, disease, disorder.
Illusion, deception, falsity.
Imagine, think, suppose, conceive, fancy.
Imbecility, impotence, weakness, debility (of mind).
Imitate, mimic, copy, ape.
Immaterial, spiritual, incorporeal, insignificant, unimportant.
Immediately, instantly, directly.
Immense, unlimited, enormous, vast
Immodest, unchaste, impudent, indecent, bold
Impair, decrease, injure, weaken.
Impart, divulge, bestow, reveal, give
Impatient, hasty, uneasy, restless.
Impeach, accuse, reproach, arraign.
Impediment, hindrance, obstruction.
Impel, urge, force, instigate, incite.
Impending, imminent, threatening.
Imperative, commanding, imperious, authoritative.
Imperfection, weakness, blemish, fault, defect.
Imperious, tyrannical, overbearing, imperative, domineering, proud.
Impertinent, irrelevant, troublesome, insolent, intrusive.
Impetuous, hasty, forcible, boisterous, vehement.
Implicate, involve, entangle.
Implore, request, solicit, supplicate, entreat.
Imply, involve, mean, signify.
Importance, consequence, weight, moment.
Importunity, solicitation.
Imprecation, anathema, malediction, curse.
Improve, advance, cultivate, correct, reform.
Impudent, insolent, bold, impertinent, saucy.
Impute, ascribe, attribute, charge.
Inability, disability, weakness.
Inactive, inert, lazy, idle.
Inadequate, incapable, insufficient, incompetent.
Inattentive, negligent, careless, thoughtless.
Incessantly, unceasingly, constantly, continually.
Incident, circumstance, event, adventure
Incite, animate, excite, encourage, stimulate.
Inclination, disposition, prepossession.
Include, contain, comprise, comprehend.
Incompetent, unsuitable, incapable, insufficient.
Inconsistent, incongruous, contrary.
Inconstant, unstable, changeable, fickle
Increase, accession, addition.
Indicate, reveal, show, mark.
Indifferent, impartial, passive, unconcerned, regardless.
Indigence, penury, want, need.
Indigenous, native
Indignation, displeasure, temper, anger.
Indiscretion, folly, imprudence.
Indispensable, necessary, essential.
Indisputable, unquestionable, incontrovertible, indubitable
Indistinct, dark, confused, ambiguous
Induce, actuate, persuade, influence, lead.
Industrious, active, diligent, persevering.
Inevitable, certain, unavoidable.
Inexorable, implacable, relentless, unyielding.
Inexpedient, inconvenient, unsuitable.
Inexpressible, ineffable, unspeakable.
Infamous, outrageous, scandalous.
Infect, pollute, contaminate, defile, corrupt
Inference, conclusion, deduction.
Inferior, subordinate, secondary.
Infested, plagued, troubled, annoyed.
Infinite, eternal, boundless, unlimited, illimitable.
Infirm, debilitated, decrepit, weak

Influence. persuasion, sway, favor.
Information, instruction, advice, intelligence.
Infringe, intrench, encroach.
Ingenious, skilful, talented.
Ingenuity, talent, skill, genius.
Inhabit, sojourn, dwell, occupy.
Inherent, inbred, inborn.
Inhuman, brutal, cruel, barbarous.
Iniquitous, unjust, wicked, nefarious.
Injunction, precept, order, command.
Injure, deteriorate, damage, hurt.
Innate, natural, inherent.
Innocent, pure, blameless, faultless.
Inordinate, immoderate, excessive.
Inquisitive, prying, curious.
Insanity, mania, lunacy.
Insensibility, imperceptibility, torpor, indifference, apathy.
Insignificant, unimportant, trivial, frivolous.
Insinuate, intimate, suggest.
Insolent, impertinent, insulting, offensive, rude, saucy.
Inspire, suggest, animate, invigorate, cheer.
Instigate, move, tempt, incite, encourage, urge.
Instruction, counsel, education, teaching, suggestion.
Insult, abuse, insolence, contempt, outrage.
Invite, bid, summon, call
Involve, implicate, entangle.
Irascible, angry, irritable, fiery.
Irony, ridicule, satire, sarcasm.
Irregular, inordinate
Irritate, exasperate, aggravate, provoke, tantalize.
Issue, consequence, effect, offspring, effect, egress, end.

Jaunt, ramble, trip, excursion.
Jealousy, envy, suspicion.
Jest, fun, joke.
Jocose, facetious, pleasant, jocular.
Join, unite, add, combine.
Joke, banter, jest, sport.
Jollity, hilarity, merriment, mirth.
Journey, tour, voyage, trip
Joy, pleasure, gayety, mirth.
Judgment, discernment, sentence, opinion.
Just, accurate, exact, honest, fair, lawful.
Justify, clear, defend, excuse, absolve.

Keen, acute, sharp, penetrating.
Keep, hold, reserve, maintain, support, retain, detain, conserve, preserve.
Kind, lenient, compassionate, indulgent; species, class.
Kindred, relationship, affinity, consanguinity.
Knavish, deceitful, dishonest.
Knowledge, perception, erudition, learning, literature.

Labor, toil, strive, work.
Lament, bewail, deplore, complain.
Language, idiom, dialect, speech.
Languid, drooping, weary, weak.
Large, great, ample, broad.
Lassitude, fatigue, weariness, languor
Last, latest, ultimate, final.
Lasting, perpetual, durable, permanent.
Latent, hidden, secret.
Laudable, commendable, praiseworthy.
Laughable, droll, ridiculous, comical.
Lavish, extravagant, prodigal, profuse.
Lazy, indolent, slothful, inert.
Lead, guide, conduct.
League, confederacy, alliance.
Lean, bend, incline.
Learning, information, literature, erudition, knowledge.
Leave, bequeath, resign, abandon.
Legitimate, genuine, lawful
Lengthen, continue, extend.
Lenity, mercy, clemency.
Lessen, degrade, diminish, reduce, decrease.
Let, hire, allow, permit.
Level, plain, even, flat.
Levity, lightness, gayety, vanity.
Liable, exposed, responsible.
Liberal, charitable, generous, benevolent.
Liberate, release, deliver, free.
Lie, falsehood, untruth, deception.
Life, being, vivacity, energy.
Lifeless, dead, inanimate, inactive.
Light, enlighten, kindle, illuminate.
Likeness, portrait, resemblance.
Liking, affection, fondness.
Limit, fix, bound.
Linger, tarry, wait, delay, loiter.
Liquid, liquor, fluid.
Listen, attend, hear.
Little, diminutive, small.
Live, reside, abide, exist.
Load, burden, encumber.
Loathe, detest, abhor.
Lodge, shelter, entertain.
Loiter, linger, saunter, tarry.
Lonely, solitary lonesome.
Look, inspect, view; appearance.
Loose, unjointed, open, licentious, vague.
Loquacious, garrulous, talkative.
Loss detriment, damage.
Lot, destiny, fate, fortune, doom.
Loud, vehement, noisy, clamorous.
Love, fondness, esteem, affection.
Lovely, beautiful, amiable, delightful, charming.
Loving, affectionate, amorous.
Low, humble, despicable, base.
Lower, debase, humiliate.
Lucky, fortunate, successful, prosperous.
Ludicrous, comical, droll, amusing.
Luxuriant, voluptuous, exuberant, abundant, excessive.

Magisterial, dignified, stately, august.
Magnificent, superb, grand, sublime, splendid.
Magnitude, greatness, bulk.
Maintain, vindicate, sustain, keep, assert, support, hold.
Majestic, august, dignified.
Malady, distemper, disease, disorder.
Malice, rancor, grudge, spite.
Manage, conduct, control.
Mandate, order, command, injunction.
Mangle, maim, mutilate, lacerate.
Manifest, open, apparent, obvious, evident
Manner, way, means, method.
Margin, rim, border, edge.
Marine, naval, maritime.
Mark, stamp, brand, impress, imprint.
Marriage, matrimony, wedlock.
Martial, warlike, military.
Marvel, miracle, wonder.
Massive, ponderous, bulky.
Master, conquer, achieve, overcome.
Mature, complete, ripe, perfect.
Maxim, proverb, adage, aphorism.
Mean, niggardly, penurious, despicable, miserly
Meaning, intention, sense, purpose, signification.
Mechanic, artificer, artisan.
Meddle, interfere, interrupt, interpose.
Meditate, muse, contemplate.
Meek, humble, mild.
Meeting, company, assembly, congregation.
Melancholy, grief, sadness, depression, distress.
Melody, concord, harmony, unison.
Melt, liquefy, dissolve.
Memory, reminiscence, recollection.
Mend, improve, repair, correct, reform.
Merchant, trader, dealer.
Merciful, compassionate, forgiving, benignant, gracious.
Merciless, unmerciful, cruel, pitiless.

Merry, joyous, lively, vivacious, mirthful.
Messenger, carrier, forerunner, harbinger.
Metaphor, symbol, similitude, allegory.
Method, system, rule, manner, mode.
Mighty, potent, strong, powerful.
Mild, tender, meek, gentle.
Minister, administer, contribute, supply.
Miracle, marvel, wonder.
Mischief, injury, harm, damage, hurt.
Miserly, avaricious, stingy, penurious, covetous.
Misfortune, calamity, mishap, harm, disaster.
Mistake, misconception, blunder, error
Mitigate, assuage, ameliorate, lessen, abate, alleviate, allay.
Mix, blend, confound, mingle.
Mock, mimic, ridicule, deride
Model, pattern, specimen, sample, copy.
Moderation, forbearance, frugality, modesty, temperance.
Modern, new, recent, novel.
Modest, bashful, unassuming, diffident, retiring.
Modify, alter, moderate, extenuate.
Molest, incommode, annoy, disturb, trouble.
Mollify, soften, assuage, appease.
Money, currency, specie.
Morose, forbidding, gloomy, sullen.
Mortification, chagrin, shame.
Motive, cause, incentive, reason.
Mourn, bemoan, lament, grieve.
Move, actuate, instigate, change, influence, stir.
Multitude, throng, crowd, swarm.
Murmur, complain, repine.
Muse, meditate, study, ponder.
Mutable, wavering, changeable, variable, unsteady.
Mutilate, injure, maim, destroy, mangle.
Mutinous, insubordination, turbulent, seditious.
Mysterious, obscure, latent, mystic, hidden, strange.

Naked, unclothed, exposed, nude.
Name, title, denomination, appellation, reputation.
Narrative, story, account.
Narrow, limited, close, contracted.
Nasty, foul, filthy, dirty.
Native, natural, natal.
Nautical, naval, marine, maritime.
Near, contiguous, close, adjacent, intimate.
Necessary, indispensable, requisite, essential.
Need, want, indigence, poverty.
Negligent, neglectful, careless, remiss.
Nevertheless, yet, however, notwithstanding.
New, modern, fresh, novel, recent.
Nice, delicate, exact, particular, pleasing.
Nigh, adjacent, close, adjoining, present.
Noble, great, illustrious, elevated, worthy.
Noisy, clamorous, loud, boisterous.
Noted, celebrated, renowned, notorious.
Notice, warning, advice, information; reveal.
Notion, perception, idea, opinion.
Notorious, noted, renowned, public, evident.
Notwithstanding, however, yet, nevertheless.
Nourish, nurture, cherish, foster.

Obdurate, hard, obstinate, stubborn.
Obedient, submissive, obsequious, dutiful.
Object, aim, subject, purpose; oppose.
Oblige, bind, favor.
Obnoxious, disagreeable, offensive, unpopular.
Obscure, indistinct, dark, doubtful.
Observe, notice, see, remark.
Obsolete, disused, old, ancient.
Obstacle, difficulty, impediment, obstruction.
Obstinate, stubborn, headstrong, contumacious.
Obstruct, hinder, impede, stop.
Obtain, get, secure, prevail, succeed.
Obtrude, intrude, interpose.
Obviate, preclude, avoid.
Obvious, apparent, clear, plain, evident.
Occasional, casual, frequent.
Occupation, employment, trade, business.
Occupy, hold, keep.
Occurrence, event, case.
Odd, strange, eccentric, uneven
Odor, smell, perfume, scent, fragrance.
Offence, crime, transgression, misdeed, trespass, insult.
Offensive, rude, insulting, abusive, obnoxious, aggressive.
Officious, intrusive, active, obtrusive.
Only, alone, solitary.
Open, unlock, candid.
Opening, aperture, cavity, fissure.
Operation, action, agency, process
Opinion, notion, thought, sentiment.
Opponent, adversary, antagonist, enemy.
Opposite, adverse, contrary.
Opprobrious, reproachful, offensive, infamous.
Opprobrium, infamy, reproach, ignominy.
Option, choice, selection.
Opulence, wealth, riches.
Oration, sermon, discourse, address, speech.
Ordain, appoint, invest, order.
Order, series, class; command, injunction; regularity.
Orderly, methodical, systematic
Ordinary, common, usual, often.
Origin, rise, beginning, descent, cause, source.
Ornament, embellish, decorate, adorn.
Ostentation, show, spectacle, display.
Outrage, violence, affront.
Outward, external, exterior.
Overbearing, haughty, domineering, lordly.
Overcome, conquer, subdue, vanquish.
Overflow, inundate, deluge.
Oversight, inattention, inadvertence, superintendence.
Overwhelm, overpower, subdue, crush
Owner, possessor, proprietor.

Pacify, conciliate, appease.
Pain, distress, pang.
Paint, depict, portray, describe, color.
Pair, two, brace, couple.
Pale, wan, pallid; fade.
Palpable, plain, apparent, gross.
Palpitate, throb, flutter, beat.
Pang, anguish, agony, distress.
Parade, ostentation, show.
Pardon, forgive, release, remit.
Parsimonious, miserly, avaricious, mean.
Part, portion, division, action, share.
Particular, exact, exclusive, distinct, peculiar, specific.
Partisan, adherent, follower.
Partner, associate, colleague, accomplice.
Passion, love, desire, anger.
Passive, unresisting, patient, submissive.
Pathetic, affecting, touching.
Patience, fortitude, perseverance, endurance, resignation.
Patient, invalid; resigned, composed.
Pay, salary, wages.
Peaceable, gentle, amiable, pacific.

Peevish, irritable, captious, harsh.
Penalty, punishment, fine.
Penitence, repentance, contrition.
Penurious, miserly, parsimonious, avaricious.
Penury, poverty, distress, indigence.
Perceive, distinguish, see, discern.
Perception, notion, idea, conception.
Peremptory, arbitrary, absolute, positive.
Perfect, complete, finished.
Perfidious, treacherous, faithless.
Perforate, pierce, penetrate.
Perform, accomplish, achieve, produce.
Perfume, smell, scent.
Period, age, era, time.
Perish, decay, die.
Permanent, lasting, durable.
Permit, allow, tolerate, admit.
Pernicious, hurtful, noxious.
Perpetrate, commit.
Perpetual, constant, lasting, continual.
Perplex, confuse, bewilder, puzzle.
Persevere, continue, persist, insist.
Persist, continue.
Perspicuity, clearness.
Persuade, influence, entice, convince, exhort.
Perverse, stubborn, cross, captious.
Pestilential, infectious, contagious.
Petition, supplication, prayer, request, entreaty.
Petulant, captious.
Picture, image, likeness, representation.
Pious, devout, religious, holy.
Pique, malice, offence
Pity, compassion, sympathy, commiseration.
Place, position, office.
Placid, calm, serene, tranquil.
Plague, annoy, torment, trouble, vex.
Plain, clear, distinct, evident, apparent, level, simple.
Plan, contrivance, scheme, design, device, arrangement, stratagem, project.
Play game, drama, amusement.
Pleasant, cheerful, gay, agreeable.
Please, satisfy, gratify, humor.
Pleasure, gratification, happiness, satisfaction, joy.
Pledge, deposit, security.
Plentiful, plenteous, ample, abundant.
Pliant, limber, flexible, pliable, supple.
Plight, condition, pledge.
Plot, conspiracy, scheme, intrigue.
Polite, courteous, genteel, refined, urbane.
Politic, prudent, wise.
Pollute, contaminate, defile.
Pompous, showy, magnificent, turgid.
Ponder, think, reflect, consider.
Portion, part, share, division, dower.
Positive, certain, real, confident, absolute.
Possess, hold, have.
Postpone, delay, procrastinate, defer.
Posture, position, attitude.
Potent, strong, powerful.
Poverty, need, want, indigence.
Powerful, potent, mighty, strong.
Practicable, possible, available, feasible.
Practice, habit, custom.
Praise, applaud, commend.
Prayer, request, entreaty, petition.
Precarious, doubtful, uncertain, dubious.
Precedence, superiority, priority.
Preceding, previous, antecedent.
Precept, rule, principle, doctrine, command.
Precious, valuable, choice, rare.
Precise, formal, accurate, nice, particular.
Preclude, prevent, hinder.
Predicament, position, condition.
Predict, foretell, prophesy, prognosticate.
Predominant, controlling, prevalent, prevailing.
Predominate, rule over, prevail.
Preference, priority, choice.
Prejudice, injury, hurt, bias.
Preliminary, introductory, previous.
Prepare, qualify, make ready, provide.
Preposterous, ridiculous, foolish, absurd, wrong.
Prerogative, privilege.
Prescribe, appoint, direct.
Pressing, squeezing, urgent, forcing, importunate.
Presume, suppose, believe, dare, surmise.
Presuming, presumptuous, arrogant.
Pretext, excuse, pretence.
Pretty, agreeable, beautiful, fine, lovely.
Prevailing, predominating, dominant, prevalent.
Prevent, hinder, obstruct.
Previous, prior, before, former.
Price, expense, cost, value.
Pride, self-esteem, vanity, conceit, arrogance.
Primary, original, pristine, first, primitive.
Principal, chief, leading, important.
Principle, motive, tenet, precept, character, doctrine.
Print, mark, picture.
Prior, before, former, previous, preceding.
Privacy, seclusion, secrecy, retirement.
Privilege, exemption, immunity, right.
Prize, reward, value.
Probability, chance, likelihood.
Probity, integrity, veracity, rectitude, virtue.
Proceed, progress, advance, arise.
Proclaim, declare, announce.
Proclivity, tendency, inclination.
Procure, furnish, get, provide.
Prodigal, wasteful, lavish, profuse.
Prodigious, monstrous, enormous.
Profane, irreligious, wicked.
Proficiency, improvement, progress, advancement.
Profit, advantage, benefit, gain.
Profligate, wicked, depraved, vicious.
Profuse, extravagant, lavish.
Prohibit, forbid, interdict, proscribe.
Project, scheme, device
Prolific, fertile, fruitful.
Prolix, tedious, diffuse, tiresome.
Prolong, extend, lengthen.
Prominent, conspicuous, protuberant.
Promise, engagement, assurance.
Promote, advance, forward, encourage.
Prompt, ready, diligent.
Pronounce, speak, declare, utter, enunciate.
Proof, demonstration, experiment.
Propagate, increase, diffuse, disseminate, spread, length, multiply, circulate.
Propensity, tendency, inclination.
Proper, right, suitable, convenient.
Propitiate, appease, conciliate, satisfy.
Propitious, auspicious, favorable.
Proportionate, adequate, equal.
Propose, intend, offer, bid.
Proprietor, owner, possessor.
Prosecute, persevere, pursue, continue.
Prospect, view, survey.
Prospective, foreseeing, future, hereafter.
Prosperous, flourishing, successful.
Protect, defend, cherish, shield, guard.
Protract, prolong, delay, defer.
Proud, conceited, arrogant, vain, haughty.
Prove, evince, manifest, demonstrate.
Proverb, saying, maxim, axiom.
Provide, furnish, prepare, procure.

Proviso, condition, stipulation.
Provoke, irritate, aggravate, enrage, tantalize.
Prudence, carefulness, judgment, wisdom.
Prying, inquisitive, curious.
Publish promulgate, proclaim, advertise.
Puerile, childish, infantile.
Pull, haul, drag, draw.
Punctual, prompt, exact.
Punish, chastise, correct, discipline.
Purchase, procure, buy.
Purpose, object, intent, reason.
Pursue, persist, follow, chase, continue.
Puzzle, bewilder, confound, perplex.

Quack, impostor, empiric, charlatan.
Quake, tremble, quiver, shake.
Qualified, capable, competent, modify.
Quality, attribute, property.
Quarrel, affray, contest, fight, altercation, contention, broil.
Query, interrogatory, doubt, inquiry.
Question, examine, ask, doubt, inquire, interrogate.
Questionable, doubtful, suspicious.
Quick, active, rapid, expeditious, ready.
Quiet, calm, ease; peaceable.
Quit, relinquish, pacify, leave, abandon.
Quota, share, proportion.

Race, generation, lineage, breed, course.
Radiance, brightness, effulgence.
Rage, fury, anger, frenzy.
Raise, elevate, heighten, erect, lift, build.
Ramble, stroll, wander; excursion.
Rancor, malice, enmity.
Rank, degree, class; rancid.
Ransom, rescue, liberate, redeem.
Rapacious, ravenous, greedy, voracious.
Rapidity, celerity, quickness, swiftness.
Rapture, ecstasy, transport, enthusiasm.
Rare, uncommon, scarce, excellent, singular, incomparable, unusual; raw.
Rash, hasty, thoughtless, headstrong.
Rate, ratio, price, proportion, degree, estimate.
Ravenous, rapacious, ferocious.
Ray, gleam, streak.
Reach, extent, stretch.
Real, true, actual, positive, authentic, certain.
Reason, motive, origin, understanding, cause, sense.
Reasonable, probable, just, equitable, rational, sensible.
Rebellion, insurrection, revolution.
Rebuke, censure, reproof, reprimand.
Recall, recant, revoke, repeal.
Recede, retire, retreat, withdraw.
Receive, accept, take.
Reciprocal, mutual, alternate.
Recite, rehearse, repeat, narrate.
Reckon, compute, count, calculate.
Reclaim, recover, correct, reform.
Recognize, acknowledge, avow, confess.
Recollection, memory, reminiscence.
Recompense, pay, reward, satisfaction, amends.
Reconcile, conciliate.
Recreation, amusement, entertainment.
Recruit, recover, repair.
Rectify, improve, amend, reform, correct, mend.
Redeem, rescue, ransom, recover.
Redress, remedy, relief, repair.
Refer, allude, relate.
Refined, polite, elegant, graceful, polished.
Reform, amend, correct, improve.
Refractory, perverse, contumacious, unmanageable, obstinate.
Refrain, forbear, abstain; chorus.
Refuse, reject, repel, rebuff, decline; dregs.
Regard, esteem, reverence, respect.
Regardless, negligent, indifferent, unconcerned.
Region, country, district, section.
Regret, complaint, sorrow, repentance.
Regulate, govern, adjust, control, direct.
Rehearse, repeat, tell.
Reject, refuse, decline, disapprove.
Rejoinder, reply, answer, response.
Reliance, confidence, dependence, trust.
Relieve, succor, alleviate, help.
Religious, holy, devout; monk, nun.
Relish, taste, enjoy.
Reluctant, unwilling, repugnant, averse.
Remain, continue.
Remainder, rest, residue, remnant.
Remark, observe, note.
Reminiscence, recollection.
Remiss, negligent, thoughtless, slack.
Remit, pardon, forgive, abate, absolve.
Remnant, remainder, residue.
Remorse, penitence, compunction, repentance.
Renew, revive, renovate, refresh.
Renounce, resign, abandon, relinquish, abjure.
Renown, fame, celebrity, glory.
Repair, recover, improve, restore, mend.
Reparation, restoration, restitution, amends.
Repeal, abrogate, abolish, recall.
Repeat, rehearse, recite, recapitulate.
Repetition, tautology, iteration, reiteration.
Replenish, refill.
Repose, sleep, quiet, rest.
Reproach, censure, upbraid, dishonor, disgrace, scorn.
Repugnance, abhorrence, dislike, antipathy, aversion, hatred.
Repugnant, adverse, contrary, hostile, inimical.
Reputation, fame, credit, repute, name.
Request, demand, beseech, beg, entreat.
Requisite, necessary, indispensable, essential.
Research, study, investigation, examination.
Resemblance, similitude, likeness, similarity.
Residence, abode, dwelling, domicile, home.
Residue, remainder, rest.
Resign, abdicate, relinquish, yield, renounce.
Resignation, endurance, patience.
Resist, oppose, withstand.
Resolution, determination, decision, courage.
Resort, frequent; haunt, recourse.
Respect, regard, esteem, veneration, honor.
Respectful, civil, deferential.
Response, rejoinder, answer, reply.
Responsible, answerable, accountable, amenable.
Rest, ease, quiet, repose; stop; remainder.
Restore, return, renew, repay, cure.
Restrain, coerce, repress, restrict, constrain.
Restrict, circumscribe, limit.
Result, effect, consequence, decision.
Retain, hold, reserve, keep.
Retard, delay, hinder, impede.
Retire, withdraw, recede, retreat.
Retract, revoke, recant, recall, abjure.
Retrieve, regain, recover.
Reveal, divulge, expose, communicate.
Revenge, avenge; retaliation.
Revere, venerate, reverence, adore.
Review, revision, retrospect, critique; examine.
Revive, renew, refresh, renovate.

Reward, compensation, desert, retribution.
Riches, wealth, opulence, affluence.
Ridicule, banter, satire, derision.
Ridiculous, absurd, preposterous, ludicrous.
Right, just, correct, honest, direct, straight; claim.
Righteous, honest, virtuous, upright, just.
Rigorous, severe, harsh, austere, strict.
Risk, venture, hazard, chance.
Rite, form, ceremony.
Road, way, route.
Room, space, apartment.
Rough, rude, unmannerly, severe, stormy, uneven.
Round, spherical, globular; circuit.
Route, way, path, road.
Rude, impudent, rough, unpolished, saucy.
Rugged, abrupt, rough.
Rule, government, regulation, law, custom, guide, maxim.

Sacred, divine, holy, hallowed.
Sad, mournful, sorrowful, dejected.
Sagacity, penetration, discernment, acuteness, wisdom.
Salary, stipend, wages, hire, pay.
Salute, address, accost, greet
Sanction, uphold, countenance, warrant, ratify; authority.
Sapient, wise, sagacious.
Sarcasm, satire, taunt
Satire, ridicule, sarcasm, irony.
Satisfaction, remuneration, compensation, atonement, contentment.
Saucy, impudent, impertinent, pert, forward
Saving, economical, frugal, penurious, thrifty; reserving, excepting.
Saying, maxim, proverb, adage, aphorism; relating, speaking.
Scandal, reproach, disgrace, infamy.
Scarce, rare, unusual, uncommon.
Scatter, dissipate, disseminate, disperse, spread.
Scent, smell, perfume, odor.
Scheme, design, system, theory.
Scope, tendency, room.
Scornful, contemptuous, disdainful.
Scruple, hesitate, waver; delicacy.
Scrupulous, conscientious, truthful, exact.
Scrutinize, examine, investigate.
Scurrilous, offensive, insulting, abusive, low, vile.
Search, examination, investigation; explore, seek.
Secede, withdraw, retire.
Seclusion, privacy, retirement.
Secondary, subordinate, inferior.
Secret, hidden, concealed, clandestine, retired, covert, occult.
Secular, worldly, temporal.
Secure, procure; safe, assured.
Security, protection, warranty, defence, deposit.
Sedate, calm, quiet, composed, serene.
Seduce, betray, decoy, tempt, mislead.
See, view, behold, look.
Seems, appears, looks.
Select, pick, choose, cull.
Sense, reason, judgment; meaning; sensation.
Sentence, period; decision, judgment; condemn
Sentiment, opinion, notion, feeling.
Separate, detach, sever, divide, withdraw.
Serene, calm, clear.
Settle, regulate, adjust, determine, clear, ratify.
Settled, decided, conclusive, established, definite.
Sever, detach, separate, divide.
Several, different, divers, sundry, various.
Severe, rigorous, austere, strict, sharp, harsh, rigid.
Shake, totter, agitate, shudder, shiver, tremble.
Shame, disgrace, ignominy, dishonor.
Shape, mould, form, figure.
Share, divide, partake, apportion, part.
Sharpness, cunning, acuteness, keenness, ingenuity; pungency.
Shelter, defend; harbor, asylum, cover.
Shine, glisten, gleam, sparkle, glitter.
Shining, brilliant, radiant, bright.
Shocking, disgusting, horrible, dreadful.
Short, scanty, brief, concise, laconic, succinct.
Shorten, contract, lessen, reduce, abbreviate.
Show, exhibition, display; direct, prove, explain, discover.
Showy, ostentatious, gay, gaudy, grand, fine, sumptuous.
Shrewd, acute, keen, sharp, sly.
Shun, avoid, evade, eschew.
Sickly, sick, unwell, diseased
Sign, mark, indication, symptom, signal.
Signify, express, denote, utter, declare, intimate, mean
Silent, mute, dumb, still.
Silly, simple, foolish.
Similarity, likeness, resemblance.
Simple, plain, silly, foolish, artless.
Simply, merely, solely, barely.
Sincere, pure, candid, true, frank, honest.
Singular, rare, particular, odd, eccentric.
Situation, condition, case, place, site, state, circumstance.
Skilful, adroit, expert, adept, able, dexterous.
Slander, vilify calumniate, defame, asperse.
Slavery, bondage, servitude.
Slender, slim, thin, slight.
Slight, neglect, disregard; cursory, trifling.
Slow, tedious, dilatory, tardy, dull.
Small, infinitesimal, narrow, little, diminutive, minute.
Smooth, mild, bland, adulatory; level, even.
Smother, suppress, suffocate, conceal.
Sneer, jeer, scoff, innuendo, slur.
Sober, abstemious, grave, sedate, moderate.
Social, convivial, companionable, familiar, sociable.
Society, association, fellowship, community.
Soft, gentle, pliant, mild, flexible, tender, silly.
Solemn, serious, grave, formal.
Solicit, ask, implore, beg, importune.
Solicitation, importunity, entreaty.
Solicitude, care, anxiety, concern.
Solid, hard, firm, substantial.
Solitary, alone, lonely, desolate.
Soothe, appease, pacify, tranquillize, assuage, allay.
Sorrow, affliction, grief, sadness.
Sort, class, species, kind, order.
Sound, healthy, firm, hearty, deep, sane; tone.
Sour, acid, acrimonious, austere, tart; cross.
Source, origin, cause.
Spacious, ample, capacious, extensive.
Sparkle, shine, glisten, glitter.
Speak, talk, utter, converse, tell, recite, declaim.
Species, kind, order, description, class.
Specific, particular, special; cure.
Specimen, sample, pattern, copy.
Spectator, observer, beholder.
Speech, oration, harangue, language, address
Speechless, dumb, mute.
Spend, expend, exhaust, waste, consume.
Sphere, globe, circle.
Spirited, vivacious, ardent, active.
Spiritual, immaterial, incorporeal, religious.
Spite, malice, hate, malignity, defiance.

Splendid, magnificent, sublime, grand, brilliant.
Splenetic, fretful, morose, peevish.
Sport, recreation, game, play, jest, amusement.
Spotless, innocent, pure, unsullied, faultless.
Spread, scatter, propagate, disperse, distribute, expand, diffuse.
Spring, arise, issue, jump, flow, emanate, start.
Sprout, vegetate, grow.
Stability, firmness, fixedness, constancy.
Stain, soil, tarnish, blot, blemish, sully.
Stammer, hesitate, stutter, falter.
Stamp, impress, mark.
Standard, criterion, model ; flag.
Stare, gape, gaze.
State, predicament, situation, condition.
Station, situation, place, rank.
Stay, support, dependence, prop ; delay, continue.
Sterility, barrenness, unproductiveness.
Stern, strict, severe, austere, rigorous.
Still, pacify, quiet, calm, appease ; silent.
Stimulate, instigate excite, urge, encourage, animate.
Stock, supply, store, property, capital ; cattle.
Stop, hinder ; cessation, stand.
Story, memoir, incident, anecdote.
Straight, immediate, direct, right.
Strange, eccentric, unusual, singular, curious, odd, unknown.
Stratagem, artifice, finesse, ruse, deceit.
Strength, force, power, energy, vigor.
Strict, stern, rigorous, severe, exact, accurate.
Strife, contest, disagreement, discord, conflict
Strive, aim, endeavor vie.
Stroll, wander, ramble, roam, rove.
Strong, hardy, robust, able, firm, vigorous, powerful, cogent.
Sturdy, robust, strong, lusty.
Style, diction, language, custom, mode ; name.
Subdue, conquer, vanquish, subjugate, overcome.
Subject, matter, object ; liable, exposed.
Sublime, great, grand, exalted, magnificent.
Submissive, yielding, obedient, humble.
Subordinate, inferior, subject, subservient.
Subsistence, living, support, maintenance, sustenance.
Substantial, responsible, stout, strong ; material, corporeal.
Substitute, change, agent.
Subtile, thin, fine, rare.
Subtle, acute, artful, cunning
Subtract, deduct, withdraw.
Subvert, reverse, overturn, pervert.
Successful, fortunate, prosperous, happy.
Succor, help, aid, relieve.
Sudden, hasty, unexpected, rash.
Suffer, allow, tolerate, permit, endure, bear, feel.
Sufficient, enough, adequate, competent, enough, plenty.
Suffrage, vote, aid, help.
Suggest, insinuate, intimate, hint.
Suitable, agreeable, appropriate, becoming, convenient.
Sullen, morose, gloomy, silent.
Summon, cite, call
Sundry, divers, various, several.
Superficial, shallow, slight, flimsy.
Supersede, displace, supplant, overrule, annul.
Supplicate, ask, implore, solicit, entreat.
Support, aid, assist, encourage, second, prop, maintain, hold, defend.
Sure, infallible, certain, confident.
Surmise, conjecture ; suppose, suspect.
Surmount, conquer, overcome, ascend.
Surpass, exceed, transcend.
Surprise, wonder, amazement, astonishment.
Surrender, yield, deliver, submit, abandon.
Surround, enclose, encompass, environ, encircle.
Survey, retrospect, prospect.
Suspense, doubt, uncertainty, indecision.
Suspicion, doubt, jealousy, distrust.
Sustain, maintain, carry, uphold, support.
Sustenance, living, support, food, maintenance.
Swiftness, speed, velocity, rapidity.
Symbol, emblem, figure, sign.
Symmetry, proportion, harmony.
Sympathy, pity, compassion, harmony.
Symptom, indication, sign, mark, token.
Synonymous, similar, alike.
System, method, order, scheme, plan.

Tale, story, narrative, novel.
Talent, genius, gift, ability.
Talk, colloquy, conversation, discourse ; speak, chat.
Tantalize, aggravate, torment, tease, vex.
Tantamount, equal, equivalent
Taste, relish, perception, flavor, judgment, sample.
Tax, customs, duties, toll, rate, burden.
Tedious, monotonous, tiresome, slow.
Tell, inform, reveal, disclose, impart, acquaint, relate, count.
Temerity, rashness, precipitancy.
Temper, disposition, quality, passion
Temperate, moderate, abstemious, calm.
Temporal, secular, worldly.
Temporary, transient, transitory, fleeting.
Tempt, induce, allure, entice, try.
Tender, bid, offer ; soft, delicate.
Tenderness, affection, love, mildness.
Tenet, principle, doctrine, dogma.
Terminate, close, end, complete.
Terms, conditions, expressions, limits.
Terrible, horrible, terrific, fearful, excessive.
Terror, fright, alarm, consternation.
Test, criterion, experiment, standard, trial
Testify, affirm, declare, signify.
Testimony, evidence.
Therefore, so, consequently, hence.
Think, consider, deliberate, ponder, meditate.
Though, although, while, however.
Thought, idea, conception, supposition, reflection, meditation.
Threaten, menace.
Throw, fling, hurl, cast.
Tie, fasten, bind ; bond, beam.
Time, epoch, period, era, season, age, opportunity.
Timid, afraid, fearful, cowardly.
Tired, fatigued, wearied, exhausted.
Title, claim, appellation, name.
Token, mark, emblem, symptom, indication.
Tolerate, allow, permit, suffer.
Torment, plague, tantalize, tease.
Total, complete, gross, whole
Touching, affecting, pathetic.
Tour, trip, excursion, journey.
Trace, vestige, clew, mark.
Traduce, decry, injure, condemn, depreciate, censure.
Tranquillity, peace, calm, quiet.
Transact, conduct, manage.
Transcend, exceed, surpass, excel.
Transient, short, brief, temporary.
Transparent, translucent, clear, pellucid
Transport, ecstasy, rapture, delight ; convey, banish.

Treacherous, heartless, perfidious, faithless.
Tremendous, dreadful, fearful, terrific, awful.
Trepidation, agitation, trembling, fear, alarm.
Trespass, transgression, violation, misdemeanor, offence.
Trial, temptation, attempt, test, experiment.
Trick, jugglery, stratagem, fraud, artifice.
Trifling, frivolous, petty, unimportant.
Trip, voyage, journey, excursion, tour.
Trouble, distress, anxiety, affliction, adversity.
Troublesome, irksome, annoying, perplexing, teasing
True, upright, honest, reliable, faithful, real.
Truth, honesty, fidelity, candor, veracity.
Try, attempt, endeavor.
Turbulent, riotous, mutinous, tumultuous.
Turn, distort, revolve, bend, twist, gyrate, wind.
Type, mark, emblem, figure, sample.

Ultimate, end, final, last.
Umpire, arbitrator, judge.
Unblemished, faultless, spotless, blameless.
Unbounded, unlimited, boundless, vast.
Unceasingly, continually, constantly, perpetually.
Uncertain, precarious, dubious, doubtful, ambiguous.
Unchangeable, immutable, unalterable.
Uncommon, scarce, singular, unusual.
Unconcerned, indifferent, regardless.
Unconquerable, insurmountable, invincible
Uncover, strip, expose.
Undaunted, intrepid, courageous, fearless.
Undeniable, unquestionable, irrefragable.
Under, subordinate, lower, inferior, beneath.
Understanding, intellect, reason, faculty, intelligence, sense.
Undetermined, vacillating, unsteady, irresolute.
Unfaithful, perfidious, treacherous, dishonest.
Unfold, display, open, divulge, expand.
Unhandy, awkward, clumsy.
Unhappy, wretched, distressed, afflicted, miserable.
Uniform, same, even, alike.
Unimportant, trivial, petty, immaterial.
Unite, combine, connect, join.
Unlearned, illiterate, ignorant.
Unlike, different, dissimilar, distinct.
Unlimited, infinite, illimitable, unbounded, boundless.
Unmerciful, cruel, merciless.
Unquestionable, indubitable, undeniable.
Unravel, extricate, disentangle.
Unrelenting, relentless, unforgiving, hard-hearted.
Unruly, ungovernable, unmanageable, refractory.
Unseasonable, unfit, untimely, late
Unsettled, doubtful, vacillating, undetermined.
Unspeakable, unutterable, ineffable.
Unstable, inconstant, changeable, mutable.
Untimely, inopportune, premature.
Untruth, falsehood, lie, falsity.
Unwilling, averse, loth, reluctant, disinclined.
Upbraid, reproach, blame, censure, rebuke.
Uproar, noise, tumult, confusion.
Urbanity, civility, suavity, affability.
Urge, encourage, press, stimulate, instigate.
Urgent, earnest, pressing, importunate.
Usage, custom, habit, treatment.
Use, utility, advantage, custom, usage, habit.
Usually, commonly, frequently, generally.
Utility, use, usefulness, advantage, benefit.
Utterly, completely, wholly, totally.

Vacant, empty, devoid, unfilled.
Vague, indefinite, unsettled, uncertain, doubtful.
Vain, ineffectual, fruitless, idle, conceited, showy.
Valedictory, farewell.
Valuable, estimable, expensive, precious, costly.
Value, estimation, appraise, price, worth, cost.
Vanity, conceit, haughtiness, arrogance, egotism.
Vanquish, confute, subdue, overcome, conquer.
Variable, changeable, capricious, fickle.
Variation, variety, change, difference, diversity.
Vehement, impetuous, eager, violent, excessive.
Velocity, quickness, speed, rapidity, celerity.
Venal, hireling, mercenary, purchasable.
Venerate, reverence, respect.
Venture, risk, hazard, chance.
Veracity, truth, honesty.
Verbal, oral, literal.
Vestige, evidence, trace, mark.
Vexation, mortification, sorrow, uneasiness, trouble, irritation.
Vicinity, nearness, neighborhood, proximity.
View, behold; picture, prospect, sight, survey, aim, opinion.
Vigorous, forcible, active, powerful, energetic, hearty, healthy.
Vile, base, impure, wicked.
Vindicate, defend, avenge, protect.
Violent, turbulent, boisterous, impetuous, tumultous.
Virtue, efficacy, chastity, purity, courage, excellence.
Visible, obvious, apparent, discernible, plain, evident.
Visionary, fanatical, fanciful; dreamer, enthusiast.
Vivid, bright, clear, lively.
Volatile, gay, lively, fickle.
Vouch, assure, warrant, affirm.
Vulgar, mean, ordinary, low, common.

Wages, salary, allowance, pay, hire.
Wakeful, vigilant, watchful.
Wan, pale, pallid.
Wander, roam, ramble, stroll.
Want, poverty, need, necessity, penury.
Ware, commodities, merchandise. goods.
Warlike, martial, military.
Warmth, heat, vehemence, ardor, vigor, fervor, cordiality, intensity.
Warning, caution, monition, admonition.
Wary, cautious, watchful, circumspect, guarded, scrupulous.
Waste, squander, spend, consume, expend, injure, damage.
Watchful, circumspect, vigilant, cautious.
Waver, scruple, hesitate, fluctuate, vacillate.
Way, path, road, plan, system, manner.
Weak, infirm, debilitated, feeble, fragile.
Weakness, folly, infirmity, imbecility feebleness, debility.
Wealth riches, affluence, opulence.
Weariness, fatigue, lassitude.
Weary, tire, fatigue.
Wedding, nuptials, marriage.

Weight, load, gravity, heaviness, influence, efficacy.
Welcome, acceptable, agreeable.
Welfare, prosperity, happiness.
Wherefore, therefore, hence, consequently.
Whimsical, fantastical, fanciful, capricious, odd.
Whiten, bleach, blanch.
Whole, undivided, total, entire, complete.
Wicked, depraved, guilty, unjust, villanous, criminal, immoral, sinful, abandoned.
Wily, cunning, subtle, artful, sly, insidious.
Win, gain, obtain, acquire, get, conciliate.
Wince, quiver, writhe, cringe, flinch, start.
Wink, blink, nictitate, connive.
Winnow, sift, eliminate, purify, separate.
Winsome, charming, attractive, lovely, sweet, fascinating.
Wisdom, understanding, knowledge, prudence, sagacity.
Withdraw, retrograde, retreat, retire, recede, separate, recall.
Withhold, forbear, hinder, refuse, refrain, restrain.
Wonder, astonishment, admiration, surprise.
Wonderful, admirable, strange, marvellous, surprising.
Worthy, meritorious, deserving.
Wretched, miserable, unhappy.
Writer, scribe, author, penman.
Wrong, injury, injustice, error.

Xantippe, scold, shrew, vixen.
Xylograph, etching, engraving, lithograph.
X Y Z, unknown quantities, ignorance.
Yap, bark, yelp, yaup.
Yawning, opening, breach, chasm, gaping, oscitation.
Yearly, annually, per annum.
Yearn, desire.
Yes, assent, consent.
Yet, nevertheless, notwithstanding, however, even, still.
Yield, surrender, concede, comply, afford, bear, deliver, give.
Youthful, juvenile, adolescent, puerile.

Zeal, enthusiasm, warmth, ardor, fervency.
Zealous, enthusiastic, anxious, earnest.
Zenith, climax, summit.
Zest, relish, pleasure, enjoyment, glee, cheer.
Zigzag, forked, crinkled, seesaw.
Zodiac, belt, girdle, band, zone.
Zone, region, belt.
Zymotic, contagious, infectious.

Probably no word in any language has a true synonyme, and though many words are sometimes used in the same sense, still each possesses a shade of meaning different from the others; hence, in the true sense of the term, the word "synonymous" cannot be applied to the preceding collection.

But, really, nice shades of meaning are not needed or desired except by the metaphysician or scientist, and the common demand is for a list of words which are suggestive of others somewhat related in signification, but which convey different ideas connected by association with still other words, thus enabling the editor, orator, poet, author, the business man, and the public generally to select the proper term to express the exact thought and sentiment in a single word, instead of losing force by circumlocution, or perspicuity by lengthy and involved sentences.

Many persons do not appreciate the benefit to be derived by the continued use of just such a list of words as is here given. Of course the larger the list the better for the professional man; but for nine tenths of the public a work like Roget's "Thesaurus" is too bulky and hides what it tries to show. The majority have not time or patience to hunt for the word; but if a choice from several can be had by a list directly before their eyes, they will make the choice, and may in time find it worth the while to use Roget's "Thesaurus" or even Crabbe's "Synonymes."

The child must learn to walk before it can run; and the grown person can only acquire that mental equipment and nimbleness needful for easy, graceful communication of thought to others by continued effort and frequent practice with the use of aids like the above. The introduction of this subject into the work was made with the hope that the general reader might be thus benefited.

There is here no explanation of the meaning of words (for that is the province of the dictionary), but simply a classification of them in accordance with their general sense, the needful discrimination with respect to their true signification and proper use being left, as it must be left, to the intuition and judgment of each individual.

Pronunciation of Foreign Languages.

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THE precise mode of reproducing the sounds of a foreign language, taken singly or in combination, as well as the general tone and style of utterance, can only be acquired through oral instruction and by long practice; but rules and directions may be given which will enable one, without the aid of a teacher, to approximate to the true pronunciation of most of the sounds, and so at least to avoid very glaring errors in regard to them. In this article no attempt is made to give a complete guide to foreign pronunciation, as such a work would require too much space, and would necessitate going into very many niceties of speech which are best treated of in formal text-books of instruction. Our only object is to aid people who are not familiar with other languages, in the proper pronunciation of the various foreign words and names which occur constantly in the newspapers and other periodicals and in general English literature. Such assistance as this is especially needed at the present time, because of the rapidly growing commercial and social intercourse between the United States and the Spanish-speaking people of Mexico and the South American states, and also on account of our increasing use of the French and German languages which necessarily accompanies extensive emigration.

Before proceeding further, and for the purposes of comparison and reference hereafter, certain peculiarities of English pronunciation should be carefully noted. The articulate sounds of the human voice are divided into two classes, vowels and consonants. The vowel sounds are those that are generally represented by the vowel letters *a*, *e*, *i*, *o*, *u*, and sometimes *w* and *y*. The consonant sounds are those that are represented by the other letters of the alphabet; namely, *b*, *c*, *d*, *f*, etc. In English there are some sixteen different vowel sounds, and four double vowels or diphthongs, recognized by the best lexicographers. The simple vowels are heard in the words *palm*, *take*, *teem*, *ball*, *note*, *moon*, *at*, *air*, *ask*, *beck*, *verge*, *tick*, *not*, *nut*, *urge*, *foot*; and the diphthongs or double vowels in the words *ice*, *oil*, *out*, *new*. By referring to the article on Phonography it will be seen that provision is there made for distinct representation of all these sounds except four, the nice distinctions between the vowels of *at*, *air*, and *ask*, of *beck* and *verge*, and of *nut* and *urge*, not being noticed. A little study of the introductory portions of that article will help to a clearer understanding of this.

All of the consonant sounds heard in the English language are represented by the series of letters given below. They are arranged, not as in the alphabet, but according to the particular part of the mouth at which they are made, commencing at the lips and proceeding backward to the teeth, the palate and the throat. The letters that are enclosed, two and two, in parentheses, are so mated because each pair represents sounds that are alike in every respect but one, which difference will be explained further on. The consonant sounds are as follows: (*p*, *b*), *m*, (*wh*, *w*), (*f*, *v*), (*th*, *dh*), (*t*, *d*), *n*, *l* (*s*, *z*), (*ch*, *j*), (*sh*, *zh*), *ni* (as in *union*), *y*, *r* (*k*, *g* hard), *ng*, *h*. If there were several more letters in the alphabet than we have, so that each simple, elementary sound, whether vowel or consonant, might have a sign of its own, we could then write words phonetically, the difficulties of spelling would almost entirely disappear, and the proper pronunciation of other languages would be much more easily acquired than now. If we examine the consonant sounds represented above, it will appear that the first seven are formed at the lips, as in the words *p*ine, *b*ine, *m*ine, *wh*ine, *w*ine, *f*ine, *v*ine; that the next eight are formed just back of the teeth, or in the middle mouth, as in the words *th*igh, *thy*, *t*ie, *d*ie, *n*igh, *l*ie, *s*igh, *Z*ion; that the next six are formed at the palate, as in the words *ch*ain, *J*ane, *g*enial, *y*ou, *sh*oe, plea*s*ure, *r*ain; and that the last four are formed at the throat, as in the words *K*ane, *g*ain, ki*ng*, *h*ang. The sounds of *b*, *w*, *v*, *dh*, *d*, *z*, *j*, *zh*, and *g* are exactly like the sounds respectively of *p*, *wh*, *f*, *th*, *t*, *s*, *ch*, *sh*, and *k*, except that each of the former has a slight undertone or vowel quality that none of the latter sounds have. Again, the sounds of *m*, *n*, *ni*, and *ng* are produced when the vocal organs are in position to utter the sounds respectively of *b*, *d*, *zh*, and *g*, and like those sounds they also have a slight vowel quality; but they differ from them in that each is accompanied with a humming sound through the nose. Compare the words (ca*b*, ca*m*), (ca*d*, ca*n*), (sei*z*ure, se*ni*or), (ra*g*, ra*ng*). These four sounds are called respectively *labial-nasal*, *dental-nasal*, *palatal-nasal*, and *guttural* or *throat nasal*.

As to the consonant letters and sounds, the following points should be mastered: *C* has no sound of its own; before *a*, *o*, and *u* is "hard," — that is, it has the sound of *k*, as in *c*ape, *c*one, *c*up; before *e*, *i*, and *y* it is "soft," — that is, it has the sound of *s*, as in *c*ell, *c*ity, *c*ypher. *Ch*, besides its usual sound, as in *ch*ild, *ch*ain, also has the sound of *k*, as in epo*ch*, and of *sh*, as in ma*ch*ine. *F* has the sound of *v* in the single word o*f*. *G*, besides its proper or "hard" sound, as in *g*ame, *g*one, has the sound of *j*, as in *g*em, en*g*ine, ca*g*e. Before *e*, *i*, and *y* it generally takes the sound of *j*, but there are many exceptions, as in *g*et, *g*ive. In a few words from the French *g* retains the sound of *zh*, as in rou*g*e. *H*, when not silent, as it is in *h*our, *h*eir, represents a mere aspiration or forcible breathing. *J* has one uniform sound, as in *j*ar, *j*est, *j*ig, *j*ob, *j*udge. *K* also has one uniform sound, as in *k*eep, *k*ind. *N*, besides its usual sound, sometimes has the sound of *ng*, as in fi*n*ger, li*n*ger, stro*n*ger. Observe the difference between the sounds of *ng* in these words, and in si*ng*er, wri*ng*er. The combination of *n* and *i*, as in pi*ni*on, compa*ni*on, represents a sound akin to, if not identical with, Spanish ñ. The sound of *ng*, as in ra*ng*, si*ng*, lo*ng*, is a simple, elementary one, and is not a compound of the sounds of *n* and *g*. *Ph* usually has the sound of *f*. In Ste*ph*en it has the sound of *v*. *Q* is always followed by *u*, and the two letters taken together have the sound of *kw*, as in *qu*ail, *qu*ench, *qu*ick, *qu*ote. In a few words, mostly from the French, they have the sound of simple *k*, as in co*qu*ette, anti*que*. *R*, when initial, as in *r*ap, *r*ack, is rough or trilled; when final, as in fa*r*, fea*r*, it is soft or smooth. In the middle of words it sometimes has one sound and sometimes the other. *S*, besides its own sound, as in *s*ail, *s*et, *s*ing, has frequently the sound of *z*, as in ha*s*, amu*s*e, ro*s*e. It also has the sound of *zh*, as in revi*s*ion, plea*s*ure. *Sh* represents a single elementary sound, as heard in *sh*ape, *sh*ock, bu*sh*. *Th* has two sounds, each of which is a simple, elementary one, as heard in (*th*in, *th*en), (e*th*er, ei*th*er), (*th*igh, *th*y). Its sound in *thy* is sometimes, for sake of distinction from the breath sound in *thigh*, represented by *dh*. *Th* also has the sound of *t*, as in *Th*omas, *Th*ames (tĕmz). *X* is a single letter that generally represents two sounds together, namely, either *ks*, as in e*x*press (ekspres), or *gz*, as in e*x*ist (egzist). At the beginning of a word it has simply the sound of *z*, as in *X*enophon, *x*ebec. *Zh* is a digraph used to represent the sound of *s* in plea*s*ure, or of *z* in sei*z*ure. The letters *zh* do not occur together in this way in any English word; but as its mate, or cognate sound, is represented usually by *sh*, and as there is no single letter in the alphabet that can be assigned to it, *zh* has been adopted as being most appropriate for the purpose. The changes in the sounds of *c* and *g*, depending upon what particular vowel letter immediately follows, cause some curious variations in the pronunciation of certain primitive words and their derivatives; thus, *focus*, *foci* (fō-sī), *fungus* (fung-gus), *fungi* (fun-jī).

The value of the vowel letters of the alphabet in the European languages is generally different from what it is in English, and may be stated as follows: *a* is equal to *ah* in English; *e*, to the name we give to the letter *a* in the alphabet; *i* to *ee*, or *i* in *fatigue*; *o* to *o*, in *note*; and *u* to *oo*, in *fool*. These sounds, thus arranged, are commonly called the European vowel scale, and it is similar to that used in phonography.

Most of the foreign languages are written or printed much nearer the phonetic standard than the English language is, the French being the least phonetic of all.

In representing the various foreign vowel sounds in the illustrative words of this article, three different modes are employed, according to which gives the best practical result in each particular case; that is to say, the vowels are sometimes indicated in what is called the English way, viz.: ah, ā, ai, or ay; ē or ēē, aw; ō or oh, ōō, ă, ĕ, ĭ, ŏ, ŭ, ŏŏ; sometimes by the diacritical marks used in Webster's Dictionary, viz., ä, ā, ē, a̤ ō, ōō, û (urge); and sometimes by the marks used in the foreign language itself.

FRENCH PRONUNCIATION.

THE alphabet of the French language is the same as the English, except that no words properly French have the letter *w*. When *w* occurs in English or other foreign words, it is pronounced like *v*. There are, however, in French, in addition to the simple, plain letters, a number of marked letters. They are as follows: à, â, é, è, ê, î, ô, ù, û and ç. These marks have nothing whatever to do with accent, in the English sense, which is a stress of voice on a particular syllable. They serve only to make ten additional letters, the pronunciation and uses of which are to be learned just as those of any other letters are. There is also the diæresis, consisting of two dots placed over *e*, *i*, and *u*, thus, ë, ï, ü, to indicate that the vowel is to be pronounced separately from the vowel that immediately precedes it, as in *naïveté* pronounced (na-iv-te′).

It will greatly facilitate the acquiring of a proper pronunciation of French, if the learner at the outset has a distinct understanding of the rule as to the *tonic accent.*

The syllable of a word which is pronounced with the greatest force is said to have the tonic accent; or, more commonly, simply the accent. Used in this sense the word *accent* must not be confused with its more frequent use with reference to the signs ˊ ˋ ˆ, which rarely are employed in French to point out the syllable that has the tonic accent.

In English the tonic accent may be laid upon,—

(*a*) The last syllable, as in *bri-gade′*.

(*b*) The last syllable but one, as in *va′-por.*

(*c*) The last syllable but two, as in *pas′-toral.*

(*d*) The last syllable but three, as in *inev′-itable.*

In French the tonic accent (except in verse) is *invariably* laid upon the *last* syllable, if the word does not end in *e mute*, and then upon the last syllable but one, as in *bri-ga·de, va-peu·r, pasto-ra·l, inevi-ta·ble.*

This important fact should be fixed in the memory, and the rule applied rigidly, because in giving hereafter illustrations both of words and of proper names, it will not be convenient to insert the accent mark. The following are a few words derived from the French, the pronunciation of which will serve as a guide in placing the accent in all French words: a-dieu′, a-chieve′, an-tique′ (an-teek′), a-droit′, ar-raign′, ac-crue′, bou-quet′ (boo-kā′), vign-ette, (vin-yet′), bru-nette′, cha-grin′, fa-tigue′, gren-a-dier′, mil-lion-naire′.

The consonant sounds heard in French are those represented by the letters p, b, m, f, v, t, d, n, l, s, z, sh, zh, ni, y, r, k, and g (hard). Particular attention is called to the fact that the following English sounds are never heard in French: *ch* as in *ch*ain; *j*, as in *j*ob; *th*, as in either *th*igh or *th*y; *ng*, as in si*ng*; and *h*, as in *h*ate.

The unmarked vowel letters are as follows: *a*, like *ah;* or, the second sound of *a*, in al*a*s; *e*, like *e* in h*e*r; *i*, like *i* in mach*i*ne; *o*, like *o* in note, not, and nor; and *u*, a little like *u* in aven*u*e. A more exact description of this sound will be found further on.

The marked vowel letters are pronounced as follows: à, like simple *a* (that is, *a* with no mark); â, like *ah*, and also like simple *a;* é (with acute accent mark), like *a* in *paper;* è (with grave accent mark), like *e* in *let*, except that it has not the characteristic of abruptness which the English short vowels have; ê, like *a* in the English word *fare;* î, like simple *i;* ô, like *o* between the sounds of *o* as in *not* and *no*, *o* in *note;* ù (occurring only in *où*, *where*, to distinguish it to the eye from *ou, or*), like simple *u*.

The combinations of vowel letters are pronounced as follows: *ai*, like one or other of the letters é, è, ê, and like *a* (ah) before liquid *l* (which see); *aie*, like é, è, ê; *ao*, generally like *o; aou, aoû,* like *ao*, and sometimes like *oo* in *moon; au* like *o*, as in *hautboy; ay* the same as *ai*, and therefore the same as é, è, or ê; *eau* like *o*, as in *beau; ei*, like *ai* (é, è, ê); *eu*, generally like the vowel sound heard in myrrh; *œ*, like é; *œi*, before *ll* or liquid *l*, like *eu; œu*, like *eu; oi*, like *wah; ou*, like *oo* in *food; oy*, the same as *oi* (*wah*).

The leading and by far the most important of the preceding combinations are: 1. *ai, ay;* 2. *au, eau;* 3. *eu, œu; and* 4, *oi, oy;* the pronunciation of which may be represented in English letters, by 1. *a;* 2. *o;* 3. *y* in *myrrh;* and 4. *wah*.

The letter *e*, unmarked, has a pronunciation and use which are very peculiar to the French language, and require particular attention. It is substantially the English vowel sound heard before *r* in the end of a word, as in *her, paper, sir, honor, herd, bird, surd.* This letter is often silent, and for that reason is called *e mute.* In the end of words having more than one vowel in ordinary speech, and when at the end of a word it follows another vowel, it is entirely silent. When *e* is inserted after a *c* or *g*, merely to prevent those letters retaining their hard sounds, it is also silent. Unmarked *e*, in certain situations, and especially in the termination *er*, in which the *r* is silent, is sounded like *é*. In pronouncing *é*, be careful to hold the sound pure and even, and not give it, as we do in English, a little vanish or taper that glides toward the sound *ee*. In the first syllable of the word *paternal*, we utter exactly the sound of French *é*.

The sounds of *u* and *eu*, in French, are not exactly like any in English, and hence they are hard for us to pronounce. The sound of *u* can be obtained in the following manner: —

Articulate the sound *ee*, as in *eel;* continue to hold the tongue in the position required for that sound; at the same time close the lips, putting them in position to utter the vowel *oo;* then, while the vocal organs are so fixed, emit sound, and it will be French *u*. In like manner, the sound of *eu*, or of German *ö*, may be produced by sounding *é;* then holding the organs rigidly in the position required by that sound, closing the lips to the position for sounding *o*, and then emitting sound.

There are in the French language four nasal vowels that are constantly occurring, to which there are no exact equivalents in English. We have the same sounds, but they are always allowed to terminate in some one of the nasal consonants *m*, *n*, or *ng*. By a little analysis, however, we can produce the sounds as they are spoken by the French. Pronounce the syllables *ahn* (än), *ăn*, *awn*, *ŭn*, at an ordinary rate of speed; then again, more slowly, and then more slowly still, allowing the voice to dwell on the vowels *ah*, *ă*, *aw*, *ŭ*, they being nasalized by the influence of the *n*. It will be noticed that at the very close of each effort the tip of the tongue rises against the roof of the mouth. Now, by pronouncing each of these syllables in the same way, but stopping before the tip of the tongue rises or moves, we have the four nasal vowels of French. The manner in which they are represented is somewhat peculiar; *ah* nasal is written by either *an*, *am*, *en*, or *em ;* *ă* nasal, by *in*, *im*, *ain*, *aim*, *ein*, or *eim ;* *aw* nasal by *on* or *om ;* and *ŭ* nasal, by *un*.

In this article, the nasalization of a vowel will be indicated by printing an italic *n* after it, thus: ah*n*, ă*n*, aw*n*, ŭ*n*.

It must not be forgotten that the *n* is silent, and that its only office is to nasalize the preceding vowel sound.

Examples: *grand* (grä*n*); quand (kä*n*), when; *pendent* (pä*n*-dä*n*), during; *ainsi* (ă*n*-see), so; *demain* (dĕ-mă*n*), to-morrow; *saint* (să*n*); *bon* (baw*n*), good; *mon* (maw*n*), my; *non* (naw*n*), no; *un* (ŭ*n*), one; *aucun* (ō-kŭ*n*), no one.

When *en* follows an *i* or *é*, it has the sound of ă*n*, as in *rien* (ree-ă*n*), nothing; *European* (Eu-ro-pē-ă*n*).

When not otherwise specified, the letters of the French alphabet are sounded as in English.

C, before the vowels, follows the rule of English pronunciation; that is, before *e*, *i*, and *y* it has the sound of *s:* and before *a*, *o*, and *u* the sound of *k*. With a cedilla (ç), it sounds like *s*, even before *a*, *o*, and *u ;* as in *façade* (fä-säde). *G* before *a*, *o*, and *u* also has the same sound as in English; but before *e*, *i*, and *y* it has the French and not the English sound of *j ;* as in *geste* (zhĕst), gesture. *Gu*, before any of the French sounds of *e* or *i*, commonly has simply the hard sound of *g*, as in *guerre* (ghĕr), war, *guillotine* (ghee-yo-teen), *guide* (gheed). (See the Italian pronunciation of *gu*.) The combination *qu* has the sound of *k*, as in *quelle* (kèl), what; *pique* (peek).

The Liquids "GN" and "LL."

The combinations *gn* and *ll* require special attention. French *gn* has the sound of *ny* in *Kenyon*, or *ni* in *union*, as in *malignité* (mă-leen-yee-tā *or* mă-lee-nyee-tā), malignity. Observe particularly that the sound of *y* in *ny* here is not the short ĭ vowel-sound that it has in such English words as *rainy*, *sunny*, but that both the *n* and the *y* have consonant values. The word *maligne*, malign, is pronounced mă-leen-y, that is, it has only two syllables, and ends with the consonant sound of *y*. By first slowly pronouncing mă-lee-nyee-ta, and then again pronouncing the same, but stopping just before uttering the *ee* in the third syllable, taking care to close with the squeezed position of the consonant *y* and its brief undertone, we have the proper pronunciation of *maligne*.

The combination *il* or *ill*, following another vowel, has the so-called liquid sound of *l*, it being really the sound of the consonant *y;* as in *guillotine* (ghee-yo-teen); *tailleur* (ta-yer), tailor; *brouillard* (broo-yär), fog; *bouteille* (boo-tèy'), bottle; *bataille* (bä-tä-y'), battle; *vieil* (vee-è-y'), old; *fille* (fee-y'), girl. In a few instances *il* or *ill* has the same sound when not preceded by another vowel; as in *billet* (bee-yè), bill, ticket; *artilleur* (ar-tee yeur), matross.

Ch is pronounced like English *sh*, thus: *chaise* (shèz), chair; *charme* (shärm), charm; *boucher* (boo-shé), butcher. *Sc* has the sound of *s*, as in *scie* (see), saw. *Th* is always pronounced as *t*, as in *thé* (tā), tea. *Ph* is pronounced *f*, as in English. *X* is equivalent to *ks* or *gz*.

H is never sounded in French; but at the beginning of some words it has the effect of preventing the blending of its first vowel with the last vowel of the preceding word, thus: *la halle* (lä äl, not l' äl), the hall. In such cases *h* is said to be *efficient*.

Final Consonants.

In regard to *t*, *d*, *s*, and *z* and *x* at the end of the words, the rule is that they are silent. Examples: *Junot* (zhu-nō), *Fauchet* (fō-shè), *Bossuet* (bŏ-suè), *St. Cloud* (săn cloo), *Talleyrand* (tă-lè-rän), *Thiers* (tee-èr).

C, *f*, *l*, and *r* are generally pronounced at the end of words. Exceptions: *l* is silent in the terminations *auld*, *ault*, *eulx*, *ould*, *oulx;* as in *Arnauld* (ar-no). *R* is silent in most words ending in *er*.

The following names will illustrate most of the principles of French pronunciation: Dorat (do-rä), Fauchet (fo-shè), Juno (zhu-nō), Gombault (gô*n*-bō), Joubert (zhoo-bèr), Gerard (zhé-rar), Richard (ree-shar), St. Gothard (să*n*-gŏ-tar), Nord (nŏr), Edouard (é-doo-ar), Edward; Fitz-James (fitz-zhăm), Thomas (tŏ-mä), Calais (kă-lè), Bruges (bruzh), Tours (toor), Lyonnais (lee-ŏ-nê), Paris (pă-ree), Vergennes (vèr-zhèn), Metz (mèss), Bordeaux (bŏr-dō), Foix (fwah), Duval (du-val), Fauvel (fō-vèl), Dez (dèz), Vésoul (vé-zool), Noyon (nwah-yô*n*), Geoffroi (zhō-frwah), Troyes (trwah), Poissy (pwah-see), Poitiers (pwah-tĭé), Quignon (kee-nyô*n*), Avignon (ă-vee-nyô*n*), Digne (deen-y'), Montaigne (mô*n*-tèn-y'), Marseille (mar-sè-y'), Ravaillac (ră-vă-yăk), Versailles (vĕr-sah-y'), Voltaire (vol-tèr), Reims (ră*n*s).

GERMAN PRONUNCIATION.

Although the German language has several sounds that are very difficult of acquirement by English-speaking people, the number of rules that are necessary to give directions on the subject of the pronunciation of the language are few. The reason of this is that,

(*a*) There are no silent letters, either vowels or consonants (excepting sometimes *h*);

(*b*) As a rule each letter has one and the same sound under all circumstances. There are exceptions as to *b*, *c*, *d*, *g*, *s*, *v*.

Vowels.

Each vowel sound is either *long* or *short*. By these terms reference is had only to the *length* of the time of utterance. In English the short sounds of the vowel-letters differ in *quality* as well as *length* from the long sounds; as in *bite*, *bit*, *note*, *not*. The Germans do not change the nature of the sound to any notable extent. It requires much practice to master this distinction; but the following rules will be found of service: —

1. When a vowel is doubled or is followed by *h*, it is long.

2. A vowel is short before a double consonant, and usually before a group of two consonants.

A has the sound of *a* in *father*, *car*. It is long in such words as *aal*, eel; *nah*, near. It is short in *ball*, ball; *hand*, hand; *hat*, has. Avoid sounding the *a* as in the English words *ball* and *hat*.

E has nearly the same sound as our *e* in *they*. It never has the vanish that we give to *ā*, especially at the end of a word, as in *day*. Short *e* has nearly the same sound as our short *e* in *met*, *men*.

E is long in *Herr*, master; *mehr*, more; and short in *denn*, then; *nett*, neat.

I has the sound of *i* in *machine*. When short it is like *i* in *pin*, only less removed from the long sound. It is long in *ihn*, him; *dir*, to the; and short in *bitten*, to ask; *ist*, is. *I* is never doubled. It is followed by *h* in a few words. Its long sound is generally indicated by the digraph *ie*.

O has always the sound of our long *o*, but without the vanish towards *oo* that we give it, as in *go*. It is long in *moor*, moor; *bohne* (bō-neh), bean, etc.; and short in *sollen*, shall; *offen*, open, etc. German *o* is never sounded as in the English words *on*, *lot*.

U long has the sound of *oo* in *pool; u* short has nearly the sound of *u* in *pull*, or *oo* in *took*, but less removed from long *u*. It is long in *uhr*, hour; *ruhen*, to rest; and short in *brust*, breast; *null*, naught. It is never doubled, and never has the sound of *u* in the English words *union*, *mute*, or in *tub*.

Y, whenever it occurs, is usually pronounced as *i* (ee) would be in the same situation.

The vowels *ä*, *ö*, *ü*, are the equivalents of *ae*, *oe*, and *ue*. They were formerly so written, and are now when the first letter is capital; afterwards the *e* came to be written above the preceding vowel, and then it finally degenerated into two dots.

Ae, *ä*, has the sound of the German *e*, but slightly approaching our short *ă*. It is long in *kläger*, plaintiff; *mähre*, mare; and short in *hände* (*han-dĕh*), hands; *fällen*, to cut down.

Oe, *ö*, has the same sound as one of the sounds of French *eu*. It is a sound made while the vocal organs are held in what may be termed a "composite" position, namely, to utter *ō* and *ā* together. See the directions for the production of French *eu*. *Oe* is long in *Oefen*, oven; *mögen*, to be able, etc.; and short in *Hölle*, hell; *Oerter*, places, positions, etc.

Ue, *ü*, has the same sound as French *u* (which see for its production). It is long in *Uebel*, evil; *müde*, weary; and short in *hütte*, hut; *dünn*, thin, etc.

Ai has the sound of *ai* in *aisle.*

Ei has the sound of English long ī as in *file*, and *ie* the sound of English long ē as in *feel.* A good way to remember these sounds is to take the last letters, *i* and *e*, and attach to them in the mind their long English sounds. The German words *wein* (wine) and *bier* (beer) will serve as guides.

Eu has nearly the sound of English *oi* or *oy*, as in *euter* (oy-tèr), udder; *neu* (noy), new.

Aeu, äu is pronounced the same as *eu*, as in *häute* (hoi-teh), skins.

Ui, found only in *Hui*, ho! *Pfui*, fie! is sounded like *we.*

Consonants.

B when final or followed by a consonant (except *r* and *l*) has the sound of *p*, as in *stab* (stahp), staff; *ob* (ohp), if. In other situations, that is, when followed in the same syllable by a vowel or by *r* and *l*, it has its proper *b* sound, as in *Biber* (bee-bĕr), beaver; *haben* (hah-bĕn), to have; *blei* (bly), lead.

C occurs singly only in words borrowed from other languages, and is then sounded as *k* before *a, o, u, l, n*, and *r;* and as *ts* before *ä, e, i*, and *y*.

Ch has a rough breathing sound which follows a vowel sound, and is made while the vocal organs are held rigidly as nearly as possible in the position they occupied while uttering the preceding vowel. It is a throat consonant or guttural after *a, o*, and *u;* and a palatal after *e, i, y, ä, ö*, and *ü*. Examples: guttural *ch, bach*, brook; *doch*, yet; *buch*, book; palatal *ch, recht*, right; *ich*, I; *löcher*, openings. *Ch* in foreign words is usually pronounced as in the language from which the words are taken: in Greek words, as *k:* in French, as *sh.*

D, at the end of a word, or of a syllable before another consonant, has the sound of *t;* as in *brod*, bread; *tödten* (töten), to kill. Before a vowel or any consonant that may intervene between it and a vowel, in the same syllable, and when doubled, *d* has the sound that it does in English; as in *du* (doo), thou; *drei* (dry), three; *troddel*, tassel.

F is always sounded as in English.

G takes the sound of German *ch* (not of *k*) in the same situations in which *b* and *d* become *p* and *t*. *Tag*, day, and *zug*, pull, are pronounced as if written *tach, zuch.* In all other cases *g* has the hard sound as in the English words *go, give, get.* It never has the sound of English *j*, as in the words *gem, gin.* This is an important fact to remember.

H, when it begins a word, or either of the suffixes, heit, haft, is sounded as in English. In all other cases it is silent.

J has always the sound of the English consonant *y*, as in *jung* (yoong), young.

K, l, m, and *n* are sounded as in English.

Ng has the sound of *ng* in *sing, singer.* It never is pronounced *ng-g*, as in *linger.* The German word *finger*, finger, is pronounced to rhyme with singer (fing-er, sing-er — not fing-ger).

P is pronounced as in English. In the combination *pf* both of the letters are sounded. *Ph* has the sound of *f.*

Q is always followed by *u*, and *qu* is pronounced nearly like *kw;* as in *qual* (kwal), pain.

R is more trilled than in English, and must always be distinctly uttered. It never degenerates into our "lazy" final *r*.

S, when final, standing before a consonant, or doubled; has its proper hissing sound; as in *glas*, glass; *hast*, haste; *wissen* (vissĕn), to know. In other cases it is pronounced like English *z;* as in *besen*, besom.

T is sounded as in English. *Th* has the sound of simple *t*, never of *th* in the English words *thin, then.*

V, initial, is sounded as *f.* In some situations *w* has a sound about half-way between English *v* and *w*. The inexperienced had better sound it always as English *v*.

W is generally pronounced as English *v*.

Z is pronounced as *ts.*

The following German names, with the pronunciation indicated, will illustrate practically the foregoing rules: —

Baden (bah′-den); Reuss (rois); Zug Spitze (tzoog-spits-ĕh); Salzburger (sahlts-boorgher); Bingen (bing′-en); Harz (harts), Weser (way-ser); Oder (oh′-dĕr); Elbe (el′-bĕh); Franke (frahn′-kĕh), Ranke (rahn′-kĕh); Böcke (bök-ĕh), Fichte (feech′-tĕh); Schelling (shel′-ing); Hegel (hay′-ghĕl); Schiller (schil′-er), Goethe (gö′-tĕh); Schlegel (shlay′-ghĕl), Heine (hy-nĕh); Heinrich (heyn′-rich); Moltke (mōlt′-kĕh).

SPANISH PRONUNCIATION.

With few exceptions, the Spanish language is pronounced as it is written.

Vowels.

Its vowel-sounds are exactly those of the Eurodean scale, viz., *ah, ā, ē, ō, oo*, being, of course, represented respectively by the letters *a, e, i, o, u.* *A* has the sound of *a* in *father; e*, of *e* in *they; i*, of *i* in *machine; o*, of *o* in *old;* and *u*, of *u* in *rule* or *oo* in *food.* *U* is silent in *gue, gui*, unless it has a diæresis over it, as in *agüero* (ah-goo-ā-rō).

THE CONSONANTS.

The consonant letters *b, f, l m, n, p, t,* and *v* are pronounced as in English. *C*, before *a, o,* and *u*, or any consonant, has the sound of *k;* but before *e* and *i* it has the sound of *th* in *think, throw.* *Ch* always has the sound that is heard in the word *chain.*

D, between two vowels and at the end of words, is sounded like *th* in *bathing, with,* etc. In all other cases it has the same sound as in English.

G before *a, o,* and *u* or a consonant has the sound heard in *gave, go, gun, grow* Before *e* and *i* it has the Spanish sound of *J* (which see).

H is never pronounced.

J has a strong, guttural, aspirated sound not found in English. The best substitute that we have for it is *h*, produced with unusual force. EXAMPLE: *Alejandro* (ah-lā-HAN-drō), Alexander

K is not used in Spanish.

LL has a sound that is nearly equivalent to that of *ll* in *brilliant.* It may be represented by *ly*, giving to the latter letter its consonant value, as in *coal-yard.*

Ñ has the sound of *ni* in *pinion*, and is equal to *ny* as in *banyan.* It is the same as French *gn* (which see).

Qu has the sound of *k*, as in *que* (kā), who.

R when double or at the beginning of words is strongly trilled; in other positions it does not differ materially in sound from English soft or final *r*.

S always has the sound of *s* in *see.*

X is sounded as in *six.* Formerly it had the aspirated sound of *J*, but this latter letter has been substituted for *x;* thus, *Quixote* (kē-hō′-tĕh) is now written in Spanish *Quijote.*

Y is sounded as in *young*, but when standing alone or at the end of a word it has the sound of *i* (ee).

Z always has the sound of *th* in *thigh, both.*

Accents. — As a general rule accent in Spanish is on the last syllable if the word ends in a consonant, and on the next to the last if it ends in a vowel. EXAMPLES: *Bailar* (bah-ē-lar′), to dance; *espada* (aiss-pah′-da), sword; *grabar* (grah-bar′), to engrave; *lengua* (lain′-gwa), language.

The following list of words illustrates the peculiarities of Spanish pronunciation as set forth in the foregoing rules: *Bajar* (bah-har′), to lower; *ageno* (ah-hai′-no), foreign; *alhaja* (al-ha′-ha), jewel; *año* (ahn-yo), year; *caridad* (kah-ree-dath′), charity; *castillo* (kas-teel′-yo), castle; *cenar* (thai-nar′), to sup; *ciento* (thee-ain′-to), a hundred; *cinco* (theen′-ko), five; *Cuba* (koo′-bah); *cuento* (kwain′-to), story; *daño* (dahn′-yo), harm; *ejercer* (ai-hayr-thayr′), to exercise; *Eespaña* (aiss-pahn′-ya), Spain; *Español* (aiss-pahn-yole′), Spanish; *excepcion* (aiks-thaip-thee-own′), exception; *leccion* (laik-thee-own′), lesson; *lleno* (lyai-no), full; *pueblo* (pwai′-blo), town; *uno* (oo′-no), one; *zapato* (thah-pah′-to), shoe.

The following list of Spanish-American names, with their pronunciation, shows that in some instances we have not adhered to strict Spanish rules: *Acapulco* (ah-kah-pool′-ko), *Vera Cruz* (vai′-rah-kroos), *Tehuantepec* (tai-wahn′-tai-pĕk), *Oajaca* (wah-hah′-kah), *Tampico* (tam-peé-ko), *Guadalaxara* (gwah-dah-lah-hah′-ra), *El Pasa* (el-pah′-so), *Chihuahua* (chē-wah′-wah), *Guaymas* (gwai′-mas), *Sierra Madre* (see-ai-ra-mah-drai), *Balize* (bah-leez′), *Yucatan* (yoo-kah-tan′), *Santiago* (sahn-tee-ah′-go), *Cienfuegos* (see-ain-fway′-goce), *Trinidad* (trin-ĭ-dad′).

ITALIAN PRONUNCIATION.

IN Italian every letter but one must be pronounced. The vowel letters are pronounced as in German, but *e* is sometimes also sounded like *a* in *and*, and *o* sometimes like *o* in loss.

The consonant letters *b, d, f, l, m, n, p, q, r, s, t, v,* and *z* are sounded as in English.

C before *a, o, u,* and *h* has the sound of *k;* before *e* and *i*, of *ch* in *cheat.* This peculiarity of Italian pronunciation is very important, and should be carefully studied.

G before *a, o, u,* and *h* has the sound of *g* in *gain;* before *e* and *i*, of *g* in *gem.*

Gl has the sound of *ll* in *billiards.*

Gn is the same as Spanish ñ.

H is never sounded. *J* has the sound of *y* in *yield.*

Sc before *a, o, u,* and *h* has the sound of *sc* in *scan;* before *e* and *i*, of *sh* in *shame.*

The following words and names will illustrate the peculiarities of Italian pronunciation: —

Agnese (än-yā′-see), Albani (äl-bä′-nee), d'Arezzo (dä-ret′-so), Baciccio (bä-cheet′-cho), Baglione (bäl-yō′-nĕh), Bartolocci (bar-to-lot′-chee), Bartolozzi (bar-to-lot′-see), Boccaccio (bok-kät′-cho), di Cagliostro (dē-käl-yos′-tro), Camuccini (kä-moot-chee′-nee), Donizetti (do-ne-dzet′-ee), Facciolati (fät-cho-lä′-tee), Faderici (fä-dĕh-ree′-chee), Falcucci (fäl-koot′-chee), Garibaldi (gä-rĕ-bäl′-dee), Giotto (jót-ō), Leonardo da Vinci (lā-o-nar-do dä vin′ chee), Lomazzo (lo-mät′-so), Luini (loo-ee′ nee), Magliabecchi (mä-lyä-bĕk′-ee), de Medici (deh mā′-de-chē), Paccioli (pät-chiō-lee),Gioachimo Pecci (jō-ä-kee′-mo pĕt′-chee), Pignotti (peen-yot′-ee), Querini (kwā-ree′-nee), Rizzio (reet′-se-o), Ristori (rees-to′ ree), Vaccaj (väk-kī′), Zuccaro (dzook′-ä-ro).

FOREIGN WORDS AND PHRASES IN COMMON USE.

Carefully selected and compiled in accordance with the latest authorities.

Note. — *Lat.* stands for *Latin; Gr.* for *Greek; Fr.* for *French; It.* for *Italian; Sp.* for *Spanish; Ger.* for *German.*

A bas. [Fr.] Down, down with.

A beau jeu, beau retour. [Fr.] One good turn deserves another.

Ab initio. [Lat.] From the beginning.

A bon marché. [Fr.] Good and cheap, good bargain.

Ab origine. [Lat.] From the origin or beginning.

A bras ouverts. [Fr.] With open arms.

Absence d'esprit. [Fr.] Absence of mind.

Ab urbe conditâ. [Lat.] From the founding of the city (Rome).

Abusus non tollit usum. [Lat.] Abuse is not an argument against proper use.

A charge. [Fr.] At expense.

A cheval. [Fr.] On horseback.

Acierta errando. [Sp.] He blunders into the right.

A corps perdu. [Fr.] With might and main.

A couvert. [Fr.] Under cover; sheltered; protected.

A cruce salus. [Lat.] Salvation from the cross.

Acta. [Lat.] Proceedings in court.

Acti labores jucundi. [Lat.] Past labors are pleasant.

Ad arbitrium. [Lat.] At pleasure.

Ad astra per aspera. [Lat.] To the stars through difficulties; — the motto of Kansas.

A dato. [Lat.] From date, or from this time.

Ad captandum. [Lat.] To please or attract.

Ad captandum vulgus. [Lat.] To catch the rabble.

A demi. [Fr.] By halves.

A dessein. [Fr.] Designedly.

Ad eundem (sc. gradum). [Lat.] To the same degree.

A deux mains. [Fr.] With both hands.

Ad extremum. [Lat.] To the extreme.

Ad finem. [Lat.] To the end

Ad gustum. [Lat.] To one's taste.

Ad hominem. [Lat.] To the man.

Ad infinitum. [Lat.] To infinity.

Ad instar. [Lat.] After the manner of.

Ad interim. [Lat.] In the mean time.

A discrétion. [Fr.] At discretion; without restriction.

Ad libitum. [Lat.] At pleasure.

Ad modum. [Lat.] After the manner of.

Ad nauseam. [Lat.] To the point of disgust.

Ad referendum. [Lat.] To be further considered.

Ad rem. [Lat.] To the point; to the purpose.

A droite. [Fr.] To the right.

Ad vivum. [Lat.] To the life.

Ægrescit medendo. [Lat.] The remedy is worse than the disease.

Affaire d'amour. [Fr.] A love affair.

Affaire d'honneur. [Fr.] An affair of honor.

Affaire du cœur. [Fr.] An affair of the heart.

A fortiori. [Lat.] With stronger reason.

A gauche. [Fr.] To the left.

A genoux. [Fr.] On the knees.

A huis clos. [Fr.] With closed doors; secretly.

Aimable. [Fr.] Amiable; lovely.

A l'abandon. [Fr.] At random; left uncared for.

A la belle étoile. [Fr.] Under the stars; in the open air.

A la bonne heure. [Fr.] In good time; well timed; very well; excellent.

A l'abri. [Fr.] Under shelter.

A la campagne. [Fr.] In the country.

A la chinoise. [Fr.] After the Chinese fashion.

A la faveur. [Fr.] By the favor of.

A la française. [Fr.] After the French mode.

A la grecque. [Fr.] After the Greek fashion.

A l'américaine. [Fr.] After the American fashion.

A la mode. [Fr.] According to the custom; in fashion.

A l'anglaise. [Fr.] After the English fashion.

A la parisienne. [Fr.] After the Parisian fashion.

A la Tartuffe. [Fr.] Like Tartuffe (hypocritically).

A l'extrémité. [Fr.] At the point of death; without resource.

Alias. [Lat.] At another time or place; elsewhere; otherwise.

A l'improviste. [Fr.] Unawares; on a sudden

Alis volat propriis. [Lat.] She flies with her own wings; — motto of Oregon.

Alla breve. [It.] Quickly.

Alla zoppa. [It.] In a lame, halting, imperfect manner.
Allégresse. [Fr.] Liveliness; sprightliness; geniality.
Allez-vous-en. [Fr.] Away with you.
Allons. [Fr.] Let us go; come on.
Alma mater. [Lat.] A benign mother.
Al occorrenza. [It.] According to circumstances.
A l'ordinaire. [Fr.] In the ordinary manner.
A l'outrance. [Fr.] To the utmost; without sparing.
Alter idem. [Lat.] Another precisely similar.
Alter ipse amicus. [Lat.] A friend is another self.
Alto rilievo. [It.] In high relief.
A main armée. [Fr.] With force of arms.
Amantium iræ. [Lat.] Lovers' quarrels.
Amende honorable. [Fr.] Satisfactory apology; reparation
Amour fait beaucoup, mais argent fait tout. [Fr.] Love is potent, but money is omnipotent.
Amour propre. [Fr.] Self-love; vanity.
Ancien régime. [Fr.] Ancient order of things.
Anglicè. [Lat.] According to the English manner.
Anguis in herbâ. [Lat.] A snake in the grass.
Animis opibusque parati. [Lat.] Prepared in mind and resources; ready to give life and property; —the motto of South Carolina.
Animus imponentis. [Lat.] The intention of the author or composer.
Anno mundi (*A. M.*). [Lat.] In the year of the world.
Anno urbis conditæ (*A. U. C.*). [Lat.] In the year the city (Rome) was built.
Ante. [Lat.] Before.
Ante bellum. [Lat.] Before the war.
Ante lucem. [Lat.] Before light.
Ante meridiem. [Lat.] Before noon.
Anti. [Lat.] Against.
A peu près [Fr.] Nearly.
A pezzi. [It.] By the piece; piece by piece.
A pied. [Fr.] On foot
A plomb. [Fr.] Perpendicularly; firmly.
A point. [Fr.] To a point; exactly right; just enough.
A posse ad esse. [Lat.] From possibility to reality.
A posteriori. [Lat.] From the effect to the cause.
Appui. [Fr.] Point of support; prop.
A prima vista. [It.] At first sight.
A priori. [Lat.] From the cause to the effect.
A propos. [Fr.] To the point.
Aqua vitæ. [Lat.] Brandy; spirit; alcohol.
Aquila non capit muscas. [Lat.] An eagle does not catch flies.
Arbiter elegantiarum. [Lat.] Master of ceremonies; an umpire in matters of taste.
Arcanum, pl. *Arcana.* [Lat.] A secret, or secrets.
Ardentia verba. [Lat.] Words that burn; glowing language.
A rebours. [Fr.] Reversed.
A reculons. [Fr.] Backward.
Argent comptant. [Fr.] Ready money.
A rivederci. [It.] Adieu until we meet again.
Arrectis auribus. [Lat.] With attentive ears.
Arrière pensée. [Fr.] A mental reservation.
Ars est celare artem. [Lat.] True art is to conceal art.
A teneris annis. [Lat.] From tender years.
A tort et à travers. [Fr.] At cross purposes.
A toute force. [Fr.] With all one's force.
A tout hasard. [Fr.] At all hazards; at all events.
A tout outrance. [Fr.] To the utmost.
A tout prix. [Fr.] At any price.
Au bon droit. [Fr.] To the just right.
Au contraire. [Fr.] On the contrary.
Au courant. [Fr.] To the present time.
Auctor pretiosa facit. [Lat.] The giver makes the gift precious.
Audax et cautus. [Lat.] Bold and wary.
Aude sapere. [Lat.] Dare to be wise.
Au désespoir. [Fr.] In despair.
Audi alteram partem. [Lat.] Hear the other side.
Au fait. [Fr.] Well instructed; expert.
Au pis aller. [Fr.] At the worst.
Au reste. [Fr.] As for the rest.
Au revoir. [Fr.] Adieu until we meet again.
Autant d'hommes, autant d'avis. [Fr.] Many men, many minds.
Auto da fé. [Portuguese.] An act of faith.
Autrefois acquit. [Fr.] Formerly acquitted.
Autre vie. [Fr.] Another's life.
Auxilium ab alto. [Lat.] Help from on high.
Avant-coureur. [Fr.] A forerunner.
Avant propos. [Fr.] Preliminary matter; preface.
Avec permission. [Fr.] By consent.
A verbis ad verbera. [Lat.] From words to blows.
A volonté. [Fr.] At pleasure.
A vostra salute. [It.] To your health.
A votre santé. [Fr.] To your health.

Bas bleu. [Fr.] A blue-stocking; a literary woman.
Battre la campagne. [Fr.] To beat the bush; to scour the country.
Bavardage. [Fr.] Idle talk; prattle; garrulity.
Beatæ memoriæ. [Lat.] Of blessed memory.
Beau idéal. [Fr.] A perfect model of beauty, or a model of ideal perfection.
Beau monde. [Fr.] The fashionable world.
Beaux esprits. [Fr.] Gay spirits; men of wit.
Beaux yeux. [Fr.] Handsome eyes; that is, attractive looks.
Bel esprit. [Fr.] A brilliant mind; a person of wit or genius.
Beneficium accipere, libertatem vendere. [Lat.] To receive a favor is to sell your liberty.
Beneplacito. [Lat.] At pleasure.
Benigno numine. [Lat.] By the favor of Providence.
Bien vienes, si vienes sola. [Sp.] Welcome, if thou comest alone.
Besoin. [Fr.] Want; need; necessity.
Bête noire. [Fr.] A black beast (object of aversion).
Biennium. [Lat.] A period of two years.
Bienvenue. [Fr.] Welcome.
Billet d'amour.
Billet doux. [Fr.] A love letter.
Bis. [Lat.] Twice; repeated.
Blasé. [Fr.] Surfeited; palled; rendered incapable of continued enjoyment.
Bon ami. [Fr.] Good friend.
Bon gré, mal gré. [Fr.] Willing or unwilling.

Bonhomie. [Fr.] Good-natured simplicity.
Bon jour. [Fr.] Good day; good morning.
Bonne. [Fr.] A nurse or governess.
Bon soir. [Fr.] Good evening.
Boutique. [Fr.] A stall for the sale of goods.
Bravo. [It.] Well done.
Brevet d'invention. [Fr.] A patent.
Brouillerie. [Fr.] Disagreement; strife.
Buona mano. [It.] A small present.

Cachot. [Fr.] A dungeon.
Cæca est invidia. [Lat.] Envy is blind.
Cambio non è furto. [It.] Exchange is no robbery.
Captatio benevolentiæ. [Lat.] A currying favor.
Caput. [Lat.] Head; chapter.
Caput mortuum. [Lat.] The worthless remains.
Carême. [Fr.] Lent; fast.
Caret initio et fine. [Lat.] It wants beginning and end.
Carpe diem. [Lat.] Enjoy the present day; seize the opportunity.
Carte de visite. [Fr.] A small photographic picture upon a card.
Casus belli. [Lat.] That which involves or justifies war.
Casus conscientiæ. [Lat.] A case of conscience.
Casus fortuitus. [Lat.] A fortuitous occurrence.
Caveat actor. [Lat.] Let the doer beware.
Cavendo tutus. [Lat.] Safe through caution.
Cede Deo. [Lat.] Submit to Providence.
Ce monde est plein de fous. [Fr.] The world is full of fools.
Certiorari. [Lat.] To be made more certain.
Certum pete finem. [Lat.] Aim at a certain end.
C'est-a-dire. [Fr.] That is to say.
C'est une autre chose. [Fr.] That is quite a different thing.
Chacun a son goût. [Fr.] Every one to his fancy.
Chacun tire de son côté. [Fr.] Every one inclines to his own side.
Chapeau bas. [Fr.] Hats off.
Chef de cuisine. [Fr.] Head cook.
Chef-d'œuvre. [Fr.] A masterpiece.
Chère amie. [Fr.] A dear friend; a mistress.
Chevalier d'industrie. [Fr.] One who lives by persevering fraud; a thief.
Chiaroscuro. [It.] Distribution of light and shade in painting.
Chi non s'arrischia, non guadagna. [It.] Nothing venture, nothing have.
Chi tace confessa. [It.] Silence is confession.
Cicerone. [It.] A guide who explains curiosities.
Ci-devant. [Fr.] Formerly; former.
Citò. [Lat.] Quickly.
Citò maturum, citò putridum. [Lat.] Soon ripe, soon rotten.
Civilitas successit barbarum. [Lat.] Civilization succeeds barbarism; — territorial motto of Minnesota.
Classes aisées. [Fr.] The classes in easy circumstances.
Cœna Domini. [Lat.] The Lord's Supper.
Coiffeur. [Fr.] A hair-dresser.
Coiffure. [Fr.] A head-dress.
Comme il faut. [Fr.] As it should be.
Commune bonum. [Lat.] A common good.
Communi consensu. [Lat.] By common consent.
Compagnon de voyage. [Fr.] A travelling companion.
Compos mentis. [Lat.] Of a sound mind.
Compositum jus fasque animi. [Lat.] Law and justice.
Compte rendu. [Fr.] Account rendered; report.
Con amore. [It.] With love; earnestly.
Concordia discors. [Lat.] Discordant harmony.
Con diligenza. [It.] With diligence.
Conditio sine quâ non. [Lat.] A necessary condition.
Con dolore. [It.] With grief.
Confrère. [Fr.] A brother belonging to the same monastery; an associate.
Conseil d'état. [Fr.] A council of state; a privy council.
Consilio et animis. [Lat.] By wisdom and courage.
Con spirito. [It.] With animation.
Constantiâ et virtute. [Lat.] By constancy and virtue.
Contra bonos mores. [Lat.] Against good manners.
Conversazione. [It.] A meeting for conversation.
Copia verborum. [Lat.] Fluency of speech.
Coram nobis. [Lat.] Before us
Corps diplomatique. [Fr.] A diplomatic body.
Corpus delicti. [Lat.] The body, substance, or foundation of the offence.
Corrigenda. [Lat.] Corrections to be made.
Corruptio optimi pessima. [Lat.] The corruption of the best becomes the worst.
Cor unum, via una. [Lat.] One heart, one way.
Couleur de rose. [Fr.] An aspect of beauty and attractiveness
Coup d'état. [Fr.] A stroke of policy; a violent measure of state in public affairs.
Coup de grâce. [Fr.] A finishing stroke.
Coup d'œil. [Fr.] A rapid glance of the eye.
Coup de soleil. [Fr.] A stroke of the sun.
Craignez honte. [Fr.] Fear disgrace.
Crescite et multiplicamini. [Lat.] Grow, or increase, and multiply; — the motto of Maryland.
Crève-cœur. [Fr.] Deep sorrow; affliction; grief.
Crux criticorum. [Lat.] The puzzle of critics.
Crux mihi anchora. [Lat.] The cross is my anchor.
Cui bono? [Lat.] What good?
Cum grano salis. [Lat.] With a grain of salt; with some allowance.
Cum privilegio. [Lat.] With privilege.
Currente calamo. [Lat.] With a running or rapid pen.
Custos morum. [Lat.] The guardian of morality.

D'accord. [Fr.] Agreed; in tune.
Dal segno. [It.] Repeat from the sign.
Dame d'honneur. [Fr.] Maid of honor.
Data et accepta. [Lat.] Expenditures and receipts.
Debito justitiæ. [Lat.] By debt of justice.
De bon augure. [Fr.] Of good omen.
De bonis non. [Lat.] Of the goods not yet administered on.
De bonne grâce. [Fr.] With good grace; willingly.
Deceptio visûs. [Lat.] An illusion of the sight.
Decrevi. [Lat.] I have decreed.
De die in diem. [Lat.] From day to day.
De facto. [Lat.] From the fact; really; by one's own authority.
Dégagé. [Fr.] Easy and unconstrained.
Dégoût. [Fr.] Disrelish; disgust.

De gustibus non est disputandum. [Lat.] There is no disputing about tastes.
Dehors. [Fr.] Without; out of; foreign; irrelevant.
Dei gratia. [Lat.] By the grace of God.
Déjeuner à la fourchette. [Fr.] A meat breakfast.
De jure. [Lat.] From the law; by right.
Delenda est Carthago. [Lat.] Carthage must be blotted out, or destroyed.
Demi-jour. [Fr.] Partial illumination; faint light.
De mortuis nil nisi bonum. [Lat.] Say nothing but good of the dead.
De nihilo nihil fit. [Lat.] Of nothing, nothing is made.
De novo. [Lat.] Anew.
Deo favente. [Lat.] With God's favor.
Deo gratias. [Lat.] Thanks to God.
Deo volente. [Lat.] God willing; by God's will.
De profundis. [Lat.] Out of the depths.
Dernier ressort. [Fr.] A last resource.
Desideratum. [Lat.] A thing desired.
De trop. [Fr.] Too much, or too many; not wanted; better away than present.
Deus vobiscum. [Lat.] God be with you.
Dicta probantia. [Lat.] Proof-texts.
Dictum. [Lat.] A saying; a decision.
Dies faustus. [Lat.] A lucky day.
Dies infaustus. [Lat.] An unlucky day.
Dies iræ. [Lat.] Day of wrath.
Dies non. [Lat.] A day on which judges do not sit.
Dieu avec nous. [Fr.] God with us.
Dieu et mon droit. [Fr.] God and my right.
Dieu vous garde. [Fr.] God protect you.
Di grado in grado. [It.] By degrees.
Di il vero e affronterai il diavolo. [It.] Speak the truth and you will shame the devil.
Dii majorum gentium. [Lat.] The gods of the superior class; the twelve superior gods.
Dii penates. [Lat.] Household gods.
Dilettante. [It.] A lover of the fine arts.
Di novelle tutto par bello. [It.] New things always appear fine.
Dirigo. [Lat.] I direct or guide; — the motto of Maine.
Diseur de bon mots. [Fr.] A sayer of good things; a wit.
Distingué. [Fr.] Distinguished; eminent.
Distrait. [Fr.] Absent in thought.
Divertissement. [Fr.] Amusement; sport.
Divide et impera. [Lat.] Divide and rule.
Divoto. [It.] Devoted.
Docendo discimus. [Lat.] We learn by teaching.
Dolce. [It.] In music, soft and agreeable.
Dolce far niente. [It.] Sweet doing-nothing.
Doli capax. [Lat.] Capable of mischief or criminal intention.
Doloroso. [It.] In music, soft and pathetic.
Domino. [It.] A mask robe.
Dominus vobiscum. [Lat.] The Lord be with you.
Dorer la pilule. [Fr.] To gild the pill.
Double entente. [Fr.] Double meaning; a play on words; often incorrectly written *double-entendre.*
Douceur. [Fr.] Sweetness; a bribe.
Doux yeux. [Fr.] Soft glances.
Dramatis personæ. [Lat.] Characters represented in a drama.
Drap d'or. [Fr.] Gold lace.
Droit des gens. [Fr.] The law of nations.
Droit et avant. [Fr.] Right and forward.
Dum spiro, spero. [Lat.] While I breathe, I hope.
Dum vivimus, vivamus. [Lat.] While we live, let us live.
Durante beneplacito. [Lat.] During good pleasure.
Durante vitâ. [Lat.] During life.

Eau de Cologne. [Fr.] Cologne water.
Eau de vie. [Fr.] Water of life; brandy.
E cattivo vento che non è buono per qualcuno. [It.] 'T is an ill wind that blows nobody good.
Ecce homo. [Lat.] Behold the man.
Ecce signum. [Lat.] Behold the sign.
Ecole de droit. [Fr.] Law-school.
E contrario. [Lat.] On the contrary.
Egal. [Fr.] Equal.
Egalité. [Fr.] Equality.
Egarement. [Fr.] Bewilderment; confusion.
Ego spem pretio non emo. [Lat.] I do not purchase hope with money.
Eheu fugaces labuntur anni. [Lat.] Alas, the fleeting years glide by.
Elapso tempore. [Lat.] The time having elapsed.
Eloge. [Fr.] A funeral oration.
Emeritus. [Lat.] One retired from active official duties.
Emigré. [Fr.] An emigrant.
Employé. [Fr.] A person employed by another; a person in service; a clerk.
Empressement. [Fr.] Ardor; zeal; interest.
En arrière. [Fr.] In the rear; back.
En avant! [Fr.] Forward!
En badinant. [Fr.] In jest; sport.
Enceinte. [Fr.] Pregnant; with child.
En cueros. [Sp.] Naked.
En déshabillé. [Fr.] In undress.
En échelon. [Fr.] In steps; like stairs.
En effet. [Fr.] In effect; substantially.
Enfans de famille. [Fr.] Children of the family.
Enfant trouvé. [Fr.] A foundling.
En grand. [Fr.] Of full size.
En grande tenue. [Fr.] In full dress.
En habiles gens. [Fr.] Like able men.
En haut. [Fr.] On high; above.
En masse. [Fr.] In a body.
Ennui. [Fr.] Weariness; lassitude.
En passant. [Fr.] In passing; by the way.
En plein jour. [Fr.] In broad day.
En règle. [Fr.] In order; according to rules.
En route. [Fr.] On the way.
Ense petit placidam sub libertate quietem. [Lat.] With the sword she seeks quiet peace under liberty; — the motto of Massachusetts.
En suite. [Fr.] In company.
Entente cordiale. [Fr.] Evidences of good-will and justice toward each other.
Entêté. [Fr.] Obstinate; heady; headstrong.
En tout. [Fr.] In all; wholly.
Entre deux feux. [Fr.] Between two fires.
Entremets. [Fr.] Small and dainty dishes set between the principal ones at table.
Entre nous. [Fr.] Between ourselves.
Entrepôt. [Fr.] A warehouse or magazine.
En vérité. [Fr.] In truth; verily.
Envoyé. [Fr.] An envoy or messenger.
Eo animo. [Lat.] With that design.
Eo nomine. [Lat.] By that name.

E pluribus unum. [Lat.] One out of many; one composed of many; — the motto of the United States, as being one government formed of many independent States.

Errare est humanum. [Lat.] To err is human.

Espérance et Dieu. [Fr.] Hope and God.

Esprit de corps. [Fr.] The animated spirit of a collective body.

Essayez. [Fr.] Try; make the attempt.

Esse. [Lat.] To be; existence.

Esse, quam videri. [Lat.] To be, rather than to seem.

Esto perpetua. [Lat.] Let it be perpetual; let it endure forever.

Et cum spiritu tuo. [Lat.] And with thy spirit.

Et id genus omne. [Lat.] And everything of the sort.

Et sequentia. [Lat.] And what follows.

Et sic de similibus. [Lat.] And so of the like.

Eureka (*εὕρηκα*, hū-re′ka). [Gr.] I have found it; — the motto of California.

Ex abrupto. [Lat.] Abruptly; suddenly.

Ex abundantiâ. [Lat.] Out of the abundance.

Ex animo. [Lat.] Heartily.

Ex capite. [Lat.] From the head; from memory.

Ex cathedrâ. [Lat.] From the bench; with high authority.

Excelsior. [Lat.] Higher; more elevated; — the motto of New York.

Exceptio probat regulam. [Lat.] The exception proves the rule.

Excerpta. [Lat.] Extracts.

Ex concesso. [Lat.] From what has been conceded.

Ex delicto. [Lat.] From the crime.

Ex dono. [Lat.] By the gift.

Exempli gratiâ. [Lat.] By way of example.

Exeunt. [Lat.] They go out.

Exeunt omnes. [Lat.] All go out or retire.

Ex facto jus oritur. [Lat.] The law springs from the fact.

Exit. [Lat.] He goes out; death.

Exitus acta probat. [Lat.] The event justifies the deed; — Washington's motto.

Ex merâ gratiâ. [Lat.] Through mere favor.

Ex necessitate rei. [Lat.] From the necessity of the case.

Ex nihilo nihil fit. [Lat.] From nothing, nothing comes.

Ex officio. [Lat.] By virtue of his office.

Ex parte. [Lat.] On one side only.

Experto crede. [Lat.] Trust one who has tried, or had experience.

Exposé. [Fr.] An exposition; recital.

Ex post facto. [Lat.] After the deed is done.

Ex tacito. [Lat.] Tacitly.

Ex tempore. [Lat.] Without premeditation.

Extra muros. [Lat.] Beyond the walls.

Extra ordinem. [Lat.] Extraordinary.

Ex uno disce omnes. [Lat.] From one learn all; from one judge of the whole.

Ex vi termini. [Lat.] By the meaning or force of the expression.

Facile princeps. [Lat.] Evidently pre-eminent; the admitted chief.

Façon. [Fr.] Manner; style.

Façon de parler. [Fr.] Manner of speaking.

Fac simile. [Lat.] Make it like; hence, a close imitation.

Fac totum. [Lat.] Do all; hence, a man of all work.

Faire bonne mine. [Fr.] To put a good face upon.

Faire mon devoir. [Fr.] To do my duty.

Fait accompli. [Fr.] A thing already done.

Fama semper vivat. [Lat.] May his fame endure forever.

Far niente. [It.] Doing nothing.

Fauteuil. [Fr.] An easy-chair.

Faux pas. [Fr.] A false step; a mistake.

Fecit. [Lat.] He made or executed it; — put after an artist's name.

Feliciter. [Lat.] Happily; successfully.

Felo de se. [Lat.] A suicide.

Femme de chambre. [Fr.] A chambermaid.

Femme de charge. [Fr.] A housekeeper.

Fête champêtre. [Fr.] A rural festival.

Fête Dieu. [Fr.] The Corpus Christi festival in the Roman Catholic Church.

Feu de joie. [Fr.] A firing of guns in token of joy; a bonfire.

Feuilleton. [Fr.] A small leaf; a supplement to a newspaper devoted to light, entertaining matter.

Fiat justitia, ruat cœlum. [Lat.] Let justice be done, though the heavens should fall.

Fiat lux. [Lat.] Let there be light.

Fide et amore. [Lat.] By faith and love.

Fidei defensor. [Lat.] Defender of the faith.

Fide, non armis. [Lat.] By faith, not by arms.

Fides et justitia. [Lat.] Fidelity and justice.

Fidus et audax. [Lat.] Faithful and bold.

Fieri facias. [Lat.] A legal term directing an execution to be levied on the goods of a debtor.

Filius nullius. [Lat.] A son of nobody.

Fille de chambre. [Fr.] A chambermaid.

Fille de joie. [Fr.] A woman of licentious pleasure.

Fils. [Fr.] Son.

Finis. [Lat.] The end.

Finis coronat opus. [Lat.] The end crowns the work.

Flagrante delicto. [Lat.] In the commission of the crime.

Flux de bouche. [Fr.] A flow of words; garrulity.

Fonctionnaire. [Fr.] A public officer.

Formaliter. [Lat.] In form.

Fortes fortuna juvat. [Lat.] Fortune aids the brave.

Fortiter in re. [Lat.] With firmness in acting.

Frais. [Fr.] Cost; expense.

Franco. [It.] Free from postage; post free.

Fraus pia. [Lat.] A pious fraud.

Front à front. [Fr.] Face to face.

Fugit hora. [Lat.] The hour flies.

Fuit Ilium. [Lat.] Troy *has* been.

Funèbre. [Fr.] Funereal; mournful.

Furor loquendi. [Lat.] A rage for speaking.

Furor scribendi. [Lat.] A rage for writing.

Garçon. [Fr.] A boy, or a waiter.

Garde du corps. [Fr.] A body-guard.

Gardez. [Fr.] Take care; be on your guard.

Gardez bien. [Fr.] Take good care.

Gardez la foi. [Fr.] Keep the faith.

Gaudeamus igitur. [Lat.] So let us be joyful.
Genius loci. [Lat.] The genius of the place.
Gens d'armes. [Fr.] Armed police.
Gens de condition. [Fr.] People of rank.
Gens de guerre. [Fr.] Military men.
Gens de langues. [Fr.] Linguists.
Gens de lettres. [Fr.] Literary people.
Gens de lois. [Fr.] Lawyers.
Gens de peu. [Fr.] Meaner sort of people.
Gentilhomme. [Fr.] A gentleman.
Gitano. [Sp.] A gypsy.
Gloria in excelsis Deo. [Lat.] Glory to God in the highest.
Gloria Patri. [Lat.] Glory be to the Father.
Goutte à goutte. [Fr.] Drop by drop.
Gouvernante. [Fr.] A governess.
Grâce à Dieu. [Fr.] Thanks to God.
Gradatim. [Lat.] Gradually; step by step.
Grande parure. [Fr.] Full dress.
Grand merci. [Fr.] Many thanks.
Gratia placendi. [Lat.] The delight of pleasing.
Gratis dictum. [Lat.] Mere assertion.

Habile. [Fr.] Skilful; able.
Hannibal ante portas. [Lat.] Hannibal before the gates; the enemy close at hand.
Haud longis intervallis. [Lat.] At brief intervals
Haut goût. [Fr.] High flavor; fine or elegant taste.
Heureusement. [Fr.] Happily.
Hic et ubique. [Lat.] Here and everywhere.
Hic jacet. [Lat.] Here lies; — used in epitaphs.
Hoc age. [Lat.] Do this; attend to what you are doing.
Hoc anno. [Lat.] In this year.
Hodie mihi, cras tibi. [Lat.] To-day to me, to-morrow it belongs to you.
Hominis est errare. [Lat.] It is common for man to err
Homme des lettres. [Fr.] A man of letters; a literary man.
Homme d'épée. [Fr.] A man of the sword; a soldier.
Homme des affaires. [Fr.] A business agent; a financier.
Homme d'esprit. [Fr.] A man of talent, or of wit.
Homme d'état. [Fr.] A statesman.
Honi soit qui mal y pense. [Fr.] Evil to him who evil thinks.
Hora e sempre. [It.] It is always time.
Hora fugit. [Lat.] The hour flies.
Hors de combat. [Fr.] Out of condition to fight.
Hors d'œuvre. [Fr.] Out of course; out of order
Hors de saison. [Fr.] Out of season.
Hôtel de ville. [Fr.] A town hall.
Hôtel garni. [Fr.] Furnished lodgings.
Humanum est errare. [Lat.] To err is human
Hunc tu caveto. [Lat.] Beware of him.

Ich dien. [Ger.] I serve.
Idée fixe. [Fr.] A fixed or definite idea
Id est. [Lat.] That is; — abbreviated to *i. e.*
Id genus omne. [Lat.] All of that sort.
Il faut de l'argent. [Fr.] Money is wanting.
Ilias malorum. [Lat.] A host of evils.
Illicite. [Fr.] Unlawful.
Il n'est sauce que d'appétit. [Fr.] Hunger is the best sauce.

Imo pectore. [Lat.] From the lowest part of the breast; from the bottom of the heart.
Impari Marte. [Lat.] With unequal strength.
Implicite. [Lat.] By implication.
Impoli. [Fr.] Unpolished; rude.
Impolitesse. [Fr.] Coarseness; rudeness.
In actu. [Lat.] In act or reality.
In æternum. [Lat.] Forever.
In ambiguo. [Lat.] In doubt.
In articulo mortis. [Lat.] At the point of death, in the last struggle
In capite. [Lat.] In the head; in chief.
In cœlo quies. [Lat.] There is rest in heaven.
In curiâ. [Lat.] In the court.
Index expurgatorius. [Lat.] A list of prohibited books.
In dubio. [Lat.] In doubt.
In equilibrio. [Lat.] In equilibrium; equally balanced.
In esse. [Lat.] In being.
In extenso. [Lat.] At full length.
In extremis. [Lat.] At the point of death.
Infinito. [Lat.] Perpetually.
In flagrante delicto. [Lat.] Taken in the fact.
Infra dignitatem. [Lat.] Below one's dignity.
In futuro. [Lat.] In future; henceforth.
In hoc signo spes mea. [Lat.] In this sign is my hope.
In hoc signo vinces. [Lat.] In this sign, or under this standard thou shalt conquer.
In loco. [Lat.] In the place; in the proper or natural place.
In loco parentis [Lat.] In the place of a parent.
In memoriam. [Lat.] To the memory of; in memory.
In nomine. [Lat.] In the name of.
In omnia paratus. [Lat.] Ready for all things.
In ovo. [Lat.] In the egg.
In pace. [Lat.] In peace.
In partibus infidelium. In infidel countries.
In perpetuam rei memoriam. [Lat.] For a perpetual memorial of the affair.
In perpetuum. [Lat.] Forever.
In posse. [Lat.] In possible existence; in possibility.
In præsenti. [Lat.] At the present time.
In propriâ personâ. [Lat.] In person.
In re. [Lat.] In the matter of.
In rem [Lat.] Against the thing or property.
In sæculâ sæculorum. [Lat.] For ages on ages.
In solo Deo salus. [Lat.] In God alone is safety
Insouciant. [Fr.] Indifferent; careless.
In statu quo. [Lat.] In the former state.
In suspenso. [Lat.] In suspense or uncertainty.
Inter alia. [Lat.] Among other things.
Inter nos. [Lat.] Between ourselves.
In terrorem. [Lat.] As a warning.
In toto. [Lat.] In the whole; entirely.
Intra muros. [Lat.] Within the walls.
Intuta quæ indecora. [Lat.] Disgraceful things are unsafe
In usu. [Lat.] In use.
Inverso ordine. [Lat.] In an inverse order.
In vino veritas. [Lat.] There is truth in wine; truth is told under the influence of wine.
Ipse dixit. [Lat.] He himself said it; dogmatism.
Ipso facto. [Lat.] In the fact itself.
Ipso jure. [Lat.] By the law itself.

Ita est. [Lat.] It is so.
Ivresse. [Fr.] Intoxication; drunkenness.

J'ai bonne cause. [Fr.] I have a good cause.
Jamais arrière. [Fr.] Never behind.
Je maintiendrai le droit. [Fr.] I will maintain the right.
Je ne sais quoi. [Fr.] I know not what.
Je suis prêt. [Fr.] I am ready.
Jeu de mots. [Fr.] A play upon words; a pun.
Jeu d'esprit. [Fr.] A witticism.
Joci causâ. [Lat.] For the sake of a joke.
Joli. [Fr.] Pretty.
Jure divino. [Lat.] By divine law.
Jure humano. [Lat.] By human law.
Juris peritus. [Lat.] One versed in law.
Jus gentium. [Lat.] Law of nations.
Jus possessionis. [Lat.] Right of possession.
Juxta. [Lat.] Near by.

Labor omnia vincit. [Lat.] Labor conquers everything.
Laborum dulce lenimen. [Lat.] The sweet solace of our labors.
Lâche. [Fr.] Lax; relaxed.
La fame non vuol leggi. [It.] Hunger obeys no law.
La gente pone, y Dios dispone. [Sp.] Men purpose, but God doth dispose.
Là, là. [Fr.] So, so; indifferently.
Laissez-nous faire. [Fr.] Let us act for ourselves.
L'amour et la fumée ne peuvent se cacher. [Fr.] Love and smoke are unable to conceal themselves.
Langage des halles. [Fr.] Slang; billingsgate.
Lapsus calami. [Lat.] A slip of the pen.
Lapsus linguæ. [Lat.] A slip of the tongue.
Lapsus memoriæ. [Lat.] A slip of memory
L'argent. [Fr.] Money.
L'avenir. [Fr.] The future.
Laus Deo. [Lat.] Praise to God.
La vertu est la seule noblesse. [Fr.] Virtue is the only nobility.
Le beau monde. [Fr.] The fashionable world.
Le bon temps viendra. [Fr.] The good time will come.
Légèreté. [Fr.] Lightness; levity.
Le mot d'énigme. [Fr.] The key of the mystery.
L'empire des lettres. [Fr.] The republic of letters.
Le pas. [Fr.] Precedence in place or rank.
Le point du jour. [Fr.] Daybreak.
Le roi le veut. [Fr.] The king wills it.
Les absens ont toujours tort. [Fr.] The absent are always in the wrong.
Les doux yeux. [Fr.] Soft glances.
Les extrêmes se touchent. [Fr.] Extremes meet.
Les murailles ont des oreilles. [Fr.] Walls have ears.
L'étoile du nord. [Fr.] The star of the north; — the motto of Minnesota.
Le tout ensemble. [Fr.] All together.
Lettre de cachet. [Fr.] A sealed letter; a royal warrant.
Lettre de change. [Fr.] A bill of exchange.
Lex non scripta. [Lat.] The unwritten law.
Lex scripta. [Lat.] Statute law.
Lex talionis. [Lat.] The law of retaliation.
Lex terræ. [Lat.] The law of the land.
L'homme propose, et Dieu dispose. [Fr.] Man proposes, and God disposes.
Liaisons dangereuses. [Fr.] Dangerous alliances.
Libertas et natale solum. [Lat.] Liberty and my native land.
Libraire. [Fr.] A bookseller.
Licentia vatûm. [Lat.] The license of the poets; poetical license.
L'inconnu. [Fr.] The unknown.
L'incroyable. [Fr.] The incredible.
Lite pendente. [Lat.] During the trial.
Locale. [Fr.] A place or station.
Locum tenens. [Lat.] One occupying the place; a deputy or substitute; a proxy.
Locus penitentiæ. [Lat.] Place for repentance.
Locus sigilli. [Lat.] The place of the seal; — usually abbreviated to L. S.
Longè aberrat scopo. [Lat.] He goes far from the mark.
Loyal en tout. [Fr.] Loyal in everything.
Lucidus ordo. [Lat.] A clear arrangement.
Lupus pilum mutat, non mentem. [Lat.] The wolf changes his coat, not his disposition.
Lusus naturæ. [Lat.] A sport or freak of nature.

Ma chère. [Fr.] My dear.
Ma foi. [Fr.] Upon my faith.
Magister ceremoniarum. [Lat.] Master of the ceremonies.
Magna est veritas, et prævalebit. [Lat.] Truth is mighty, and it will prevail
Magnum bonum. [Lat.] A great good.
Magnum est vectigal parsimonia. [Lat.] Economy is itself a great income.
Magnum opus. [Lat.] A great work.
Maigre. [Fr.] Fasting; fish diet.
Maintien. [Fr.] Deportment; carriage; address.
Maintiens le droit. [Fr.] Maintain the right.
Maison de campagne. [Fr.] A country-seat.
Maison de ville. [Fr.] The town-house.
Maître d'hôtel. [Fr.] A house-steward.
Maîtresse. [Fr.] Mistress.
Maladie du pays. [Fr.] Homesickness.
Malâ fide. [Lat.] With bad faith; treacherously.
Mal à propos. [Fr.] Ill-timed.
Mal de mer. [Fr.] Seasickness.
Mal entendre. [Fr.] An error; mistake.
Malgré soi. [Fr.] In spite of himself.
Malheur ne vient jamais seul. [Fr.] Misfortunes seldom come singly.
Malo modo. [Lat.] In a bad manner.
Malpropre. [Fr.] Unclean; slovenly.
Malum in se. [Lat.] Bad in itself.
Malum prohibitum. [Lat.] An evil prohibited; evil because prohibited
Malus pudor. [Lat.] False shame.
Manu propriâ. [Lat.] With one's own hand.
Mardi gras. [Fr.] Shrove-Tuesday.
Materfamilias. [Lat.] The mother of a family.
Mauvaise honte. [Fr.] False modesty.
Mauvais goût. [Fr.] Bad taste.
Mauvais sujet. [Fr.] A bad subject; a worthless fellow.
Maximus in minimis. [Lat.] Very great in trifling things.
Mediocra firma. [Lat.] The middle station is surest.

Medium tenuere beati. [Lat.] Happy are they who have kept the middle course.

Memento mori. [Lat.] Remember death.

Memorabilia. [Lat.] Things to be remembered.

Memoriâ in æternâ. [Lat.] In everlasting remembrance.

Mens agitat molem. [Lat.] Mind moves matter.

Mens legis. [Lat.] The spirit of the law.

Mens sana in corpore sano. [Lat.] A sound mind in a sound body.

Meo periculo [Lat.] At my own risk.

Mésalliance. [Fr.] Improper association; marriage with one of lower station.

Mirabile dictu. [Lat.] Wonderful to be told.

Mirabilia. [Lat.] Wonders.

Mise en scène. [Fr.] The getting up, or putting in preparation, for the theatrical stage.

Modus. [Lat.] Manner; mode.

Modus operandi. [Lat.] Manner of operation.

Mole ruit suâ. [Lat.] It is crushed by its own weight.

Mon ami. [Fr.] My friend.

Mon cher. [Fr.] My dear.

Montani semper liberi. [Lat.] Mountaineers are always free men; — the motto of West Virginia.

More Hibernico. [Lat.] After the Irish fashion.

More suo. [Lat.] In his own way.

Mors omnibus communis. [Lat.] Death is common to all

Mos pro lege. [Lat.] Custom for law.

Motivé. [Fr.] Supported by a statement of reasons or arguments alleged.

Mots d'usage. [Fr.] Words in common use.

Multum in parvo. [Lat.] Much in little.

Mutatis mutandis. [Lat.] The necessary changes being made.

Mutuus consensus. [Lat.] Mutual consent.

Naissance. [Fr.] Birth.

Natale solum. [Lat.] Natal soil.

Ne cede malis. [Lat.] Yield not to misfortune.

Necessitas non habet legem. [Lat.] Necessity has no law.

Nec scire fas est omnia. [Lat.] It is not permitted to know all things.

Née. [Fr.] Born; maiden name.

Ne exeat. [Lat.] Let him not depart.

Ne fronti crede. [Lat.] Trust not to appearances.

Négligé. [Fr.] A morning dress.

Nemine dissentiente. [Lat.] No one dissenting.

Ne plus ultra. [Lat.] Nothing further; the uttermost point.

Ne puero gladium. [Lat.] Intrust not a sword to a boy.

Nervus probandi. [Lat.] The chief argument.

Ne tentes, aut perfice. [Lat.] Attempt not, or accomplish thoroughly.

Nettetè. [Fr.] Neatness; cleanness; nicety.

Niaiserie. [Fr.] Foolishness; silliness.

Nihil ad rem. [Lat.] Nothing to the point.

Nihil debet. [Lat.] He owes nothing; a plea denying a debt.

Nil admirari [Lat.] To wonder at nothing.

Nil desperandum. [Lat.] Never despair.

Nil dicit. [Lat.] He makes no answer.

Ni l'un ni l'autre. [Fr.] Neither the one nor the other.

N'importe. [Fr.] It matters not.

Noblesse oblige. [Fr.] Rank imposes obligation.

No es oro todo lo que reluce. [Sp.] All is not gold that glitters.

Nolens volens. [Lat.] Whether he will or not.

Noli me tangere. [Lat.] Don't touch me.

Nolle prosequi. [Lat.] To be unwilling to proceed.

Nom de guerre. [Fr.] A war name; a travelling title; a pseudonyme.

Nom de plume. [Fr.] An assumed or literary title.

Non constat. [Lat.] It does not appear.

Non ens. [Lat.] Nonentity.

Non est inventus. [Lat.] He has not been found.

Non libet. [Lat.] It does not please me.

Non liquet. [Lat.] It is not clear.

Non obstante. [Lat.] Notwithstanding.

Non omnis moriar. [Lat.] I shall not wholly die.

Non sequitur. [Lat.] It does not follow; an unwarranted conclusion.

Non sibi, sed patriæ. [Lat.] Nor for himself, but for his country.

Non sum qualis eram. [Lat.] I am not what I was.

Noscitur a (or *ex*) *sociis.* [Lat.] He is known by his companions.

Notatu dignum. [Lat.] Worthy of note.

Notre Dame. [Fr.] Our lady.

N'oubliez pas. [Fr.] Don't forget.

Nouvelles. [Fr.] News.

Nudis verbis. [Lat.] In plain words.

Nul bien sans peine. [Fr.] No pains, no gains.

Nullius filius. [Lat.] The son of nobody.

Nunc aut nunquam. [Lat.] Now or never.

Nuptiæ. [Lat.] Nuptials; wedding.

Nusquam tuta fides. [Lat.] Our confidence is nowhere safe.

Obiit. [Lat.] He, or she, died.

Obiter dictum. [Lat.] A thing said by the way, or in passing.

Œuvres [Fr.] Works.

Œil de bœuf. [Fr.] A bull's eye.

Omne bonum de super. [Lat.] All good is from above.

Omne ignotum pro magnifico. [Lat.] Whatever is unknown is thought to be magnificent.

Omnem movere lapidem. [Lat.] To turn every stone; to leave no stone unturned.

Omnia vincit amor. [Lat.] Love conquers all things.

Omnia vincit labor. [Lat.] Labor overcomes all things.

Omnis amans amens. [Lat.] Every lover is demented.

On dit. [Fr.] They say; hence, a flying rumor.

Onus probandi. [Lat.] The burden of proving.

Operæ pretium est. [Lat.] It is worth while.

Optimates. [Lat.] Of the first rank.

Ora e sempre. [It.] Now and always.

Ora et labora. [Lat.] Pray and work.

Ora pro nobis. [Lat.] Pray for us.

O tempora! O mores! [Lat.] O the times! O the manners!

Otia dant vitia. [Lat.] Idleness tends to vice.

Otium cum dignitate. [Lat.] Ease with dignity; dignified leisure.

Otium sine dignitate. [Lat.] Ease without dignity

Otium sine literis mors est. [Lat.] Leisure without literature is death.
Ouï-dire. [Fr.] Hearsay.
Ouvert. [Fr.] Open.
Ouvrage. [Fr.] A work.
Ouvrage de longue haleine. [Fr.] A work for long breath; a tedious business.
Ouvriers. [Fr.] Operatives; workmen.

Pace tuâ. [Lat.] With your consent.
Pacta conventa. [Lat.] The conditions agreed upon.
Padrone. [It.] Master; employer: landlord.
Par accès. [Fr.] By snatches or starts.
Par accident. [Fr.] By chance.
Par accord. [Fr.] By agreement.
Par avance. [Fr.] In advance.
Par ci par là. [Fr.] Here and there.
Par complaisance. [Fr.] From complaisance.
Par exemple. [Fr.] For example.
Par excellence. [Fr.] By way of eminence.
Parri passu. [Lat.] With equal pace; together.
Parole d'honneur. [Fr.] Word of honor.
Par précaution. [Fr.] By way of precaution.
Pars adversa. [Lat.] The adverse party.
Pars pro toto. [Lat.] Part for the whole.
Particeps criminis. [Lat.] An accomplice.
Particulier. [Fr.] A private gentleman.
Partout. [Fr.] Everywhere.
Parvum parva decent. [Lat.] Little things become a little person.
Passager. [Fr.] A passenger.
Passe partout. [Fr.] A master-key.
Pâté de foie gras. [Fr.] Goose-liver pie.
Paterfamilias. [Lat.] The father of a family.
Pater noster. [Lat.] Our Father; the Lord's prayer.
Pater patriæ. [Lat.] Father of his country.
Patience passe science. [Fr.] Patience exceeds knowledge.
Pâtisserie. [Fr.] Pastry.
Pax in bello. [Lat.] Peace in war.
Peccavi. [Lat.] I have sinned.
Pendente lite. [Lat.] Pending the suit.
Pensée. [Fr.] A thought.
Per aspera ad astra. [Lat.] Through trials to glory.
Per capita. [Lat.] By the head.
Per centum. [Lat.] By the hundred.
Per contra. [Lat.] Contrariwise.
Per diem. [Lat.] By the day.
Perdu. [Fr.] Lost.
Père de famille. [Fr.] The father of a family.
Per gradus. [Lat.] Step by step.
Per interim. [Lat.] In the mean time.
Per mese. [It.] By the month.
Perpetuum silentium. [Lat.] Perpetual silence.
Per se. [Lat.] By itself considered.
Pessimi exempli. [Lat.] Of the worst example.
Petit. [Fr.] Small.
Petitio principii. [Lat.] A begging of the question.
Petit-maître. [Fr.] A fop.
Peu à peu. [Fr.] Little by little; by degrees.
Peu de chose. [Fr.] A trifle.
Pis aller. [Fr.] The last or worst shift.
Plebs. [Lat.] Common people.
Plein pouvoir. [Fr.] Full power.
Pleno jure. [Lat.] With full authority.
Poca roba, poco pensiero. [It.] Little wealth, little care.
Poco à poco. [It.] Little by little.
Poisson d'avril. [Fr.] April fool.
Populus vult decipi. [Lat.] People like to be deceived.
Poste restante. [Fr.] To remain until called for; —applied to letters in the post-office.
Post mortem. [Lat.] After death.
Post obitum. [Lat.] After death.
Potage au gras. [Fr.] Meat soup.
Pour passer le temps. [Fr.] To pass away the time.
Præmonitus, præmunitus. [Lat.] Forewarned, forearmed.
Prescriptum. [Lat.] A thing prescribed.
Prêt pour mon pays. [Fr.] Ready for my country.
Prima facie. [Lat.] On the first view.
Primo. [Lat.] In the first place.
Principia, non homines. [Lat.] Principles, not men.
Prior tempore, prior jure. [Lat.] First in time, first by right; or first come, first served.
Probatum est. [Lat.] It is proved.
Pro bono publico. [Lat.] For the public good.
Procès verbal. [Fr.] A written statement.
Pro et con. [Lat.] For and against.
Pro formâ. [Lat.] For the sake of form.
Pro nunc. [Lat.] For the present.
Propagandâ fide. [Lat.] For extending the faith.
Pro patriâ. [Lat.] For our country.
Pro ratâ. [Lat.] In proportion.
Pro tanto. [Lat.] For so much.
Protégé. [Fr.] One protected or patronized by another.
Pro tempore. [Lat.] For the time being.

Quære. [Lat.] Query; inquiry.
Quamdiu se bene gesserit. [Lat.] During good behavior.
Quantum. [Lat.] The quantity or amount.
Quantum libet. [Lat.] As much as you please.
Quantum sufficit. [Lat.] A sufficient quantity.
Quasi. [Lat.] As if; in a manner.
Quid faciendum? [Lat.] What is to be done?
Quid nunc? [Lat.] What now? a newsmonger.
Qui docet, discit. [Lat.] He who teaches, learns.
Quid pro quo. [Lat.] One thing for another; an equivalent.
Quid rides? [Lat.] Why do you laugh?
Quid times? [Lat.] What do you fear?
Qui nimium probat, nihil probat. [Lat.] He who proves too much, proves nothing.
Qui pense? [Fr.] Who thinks?
Qui tacet consentit. [Lat.] He who is silent gives consent.
Qui transtulit, sustinet. [Lat.] He who transplanted, still sustains; —the motto of Connecticut.
Qui va là. [Fr.] Who goes there?
Qui vive? [Fr.] Who goes there? —hence, on the *qui vive*, on the alert.
Quo animo? [Lat.] With what mind or intention?
Quod erat demonstrandum. [Lat.] Which was to be proved or demonstrated.
Quod hoc sibi vult? [Lat.] What does this mean?
Quod vide. [Lat.] Which see.
Quo jure? [Lat.] By what right?
Quomodo? [Lat.] In what manner? how?

Raison d'état. [Fr.] A reason of state.
Rara avis. [Lat.] A rare bird; a prodigy.
Rata. [Lat.] Rate; one's own share.
Recte et suaviter. [Lat.] Justly and mildly.
Reçu. [Fr.] Received; receipt.
Reductio ad absurdum. [Lat.] A reducing a position to an absurdity.
Regnant populi. [Lat.] The people rule; — the motto of Arkansas. [Properly, *Regnat populus.*]
Religieuse. [Fr.] A nun.
Religieux. [Fr.] A monk; a friar.
Remuda de pasturage haze bizerros gordos. [Sp.] Change of pasture makes fat calves.
Renaissance. [Fr.] Revival, as of letters or art.
Renommée. [Fr.] Renown; fame.
Renovate animos. [Lat.] Renew your courage.
Rentes. [Fr.] Funds bearing interest; stocks.
Requiescat in pace. [Lat.] May he rest in peace.
Res gestæ. [Lat.] Exploits
Résumé. [Fr.] An abstract or summary.
Resurgam. [Lat.] I shall rise again.
Revenons a nos moutons. [Fr.] Let us return to our sheep; let us return to our subject.
Rira bien, qui rira le dernier. [Fr.] He laughs well who laughs last.
Robe de chambre. [Fr.] A dressing gown or morning gown.
Rus in urbe. [Lat.] The country in town.

Sal Atticum. [Lat.] Attic salt; wit.
Salle. [Fr.] Hall.
Salus populi suprema est lex. [Lat.] The welfare of the people is the supreme law; — the motto of Missouri.
Salvo pudore. [Lat.] Without offence to modesty.
Sanctum sanctorum. [Lat.] Holy of holies.
Sans cérémonie. [Fr.] Without ceremony.
Sans Dieu rien. [Fr.] Nothing without God.
Sans doute. [Fr.] Without doubt
Sans peur et sans reproche. [Fr.] Without fear and without reproach.
Sans tache. [Fr.] Without spot; stainless.
Sat cito, si sat bene. [Lat.] Soon enough, if but well enough.
Sat pulchra, si sat bona. [Lat.] Handsome enough, if good enough.
Savoir-faire. [Fr.] Ability; contrivance or skill.
Savoir-vivre. [Fr.] Good breeding; refined manners.
Savon. [Fr.] Soap.
Scire facias. [Lat.] Cause it to be known.
Secundum artem. [Lat.] According to rule; scientifically.
Se defendendo. [Lat.] In self-defence.
Semper fidelis. [Lat.] Always faithful.
Semper idem. [Lat.] Always the same.
Semper paratus. [Lat.] Always ready.
Sensu bono. [Lat.] In a good sense.
Sensu malo. [Lat.] In a bad sense.
Servabo fidem. [Lat.] I will keep faith.
Sic passim. [Lat.] So everywhere.
Sic semper tyrannis. [Lat.] Ever so to tyrants; — the motto of Virginia.
Sic transit gloria mundi. [Lat.] So passes away earthly glory.
Si je puis. [Fr.] If I can.
Similia similibus curantur. [Lat.] Like things are cured by like; principle of homœpathy.
Sine curâ. [Lat.] Without charge or care.
Sine die. Without a day appointed.
Sine dubio. [Lat.] Without doubt.
Sine invidiâ. [Lat.] Without envy.
Sine morâ. [Lat.] Without delay.
Sine odio. [Lat.] Without hatred.
Sine præjudicio. [Lat.] Without prejudice.
Sine qua non. [Lat.] An indispensable condition.
Si quæris peninsulam amœnam, circumspice. [Lat.] If thou seekest a beautiful peninsula, behold it here; — the motto of Michigan.
Sit tibi terra levis. [Lat.] May the earth lie lightly upon thee.
Si vis pacem, para bellum. [Lat.] If you wish for peace, prepare for war.
Sola nobilitas virtus. Virtue, the only nobility.
Sottise. [Fr.] Foolishness; folly; nonsense.
Soubrette. [Fr.] An intriguing woman.
Sous tous les rapports. [Fr.] In all respects.
Soyez ferme. [Fr.] Be firm.
Spero meliora. [Lat.] I hope for better things.
Spirituel. [Fr.] Intellectual, witty.
Sponte suâ. [Lat.] Of one's own accord.
Status quo. [Lat.] The state in which.
Stet. [Lat.] Let it stand.
Suaviter in modo, fortiter in re. [Lat.] Gentle in manners, but resolute in deed.
Sub colore juris. [Lat.] Under color of law.
Sub conditione. [Lat.] Under the condition.
Sub hoc signo vinces. [Lat.] Under this standard you shall conquer.
Sub judice. [Lat.] Under consideration.
Sub prætextâ juris. [Lat.] Under the pretext of justice.
Sub rosâ. [Lat.] Under the rose; privately.
Sui generis. [Lat.] Of its own kind.
Sui juris. [Lat.] In one's own right.
Summum bonum. [Lat.] The chief good.
Suum cuique. [Lat.] Let each have his own.

Tableau vivant. [Fr.] A living and silent group.
Tâche sans tache. [Fr.] A work without a stain.
Tant mieux. [Fr.] So much the better.
Tant pis. [Fr.] So much the worse.
Tant soit peu. [Fr.] Never so little.
Tel maître, tel valet. [Fr.] Like master, like man.
Tempora mutantur, et nos mutamur in illis. [Lat.] The times are changed, and we are changed with them.
Tempus fugit. [Lat.] Time flies.
Tempus omnia revelat. [Lat.] Time reveals all things.
Tenez. [Fr.] Take it.
Tentanda via est. [Lat.] A way must be tried.
Terra cotta. [It.] Baked earth.
Terra firma. [Lat.] Solid earth; a safe footing.
Terra incognita. [Lat.] An unknown country.
Tiens à la vérité. [Fr.] Maintain the truth.
Tiens ta foi. [Fr.] Keep thy faith.
Tintamarre. [Fr.] A confused noise; racket; din.
Totidem verbis. [Lat.] In just so many words.
Totum. [Lat.] The whole.
Toujours prêt. [Fr.] Always ready.
Tour de force. [Fr.] A feat of strength or skill.
Tout-à-fait. [Fr.] Entirely; wholly.
Tout-à-l'heure. [Fr.] Instantly.
Tout au contraire. [Fr.] On the contrary.

Tout à vous. [Fr.] Wholly yours.

Tout de même. [Fr.] Precisely the same.

Tout de suite. [Fr.] Immediately.

Tout ensemble. [Fr.] The whole taken together.

Tout frais fait. [Fr.] All expense defrayed.

Tout lui rit. [Fr.] All goes well with him.

Tripotage. [Fr.] Medley; miscellany.

Troja fuit. [Lat.] Troy was; that is, Troy is no more.

Tuum est. [Lat.] It is your own.

Ubi jus incertum, ibi jus nullum. [Lat.] Where the law is uncertain, there is no law.

Ubique. [Lat.] Everywhere.

Ultima Thule. [Lat.] The utmost boundary or limit.

Ultimatum. [Lat.] The last or only condition.

Ultra licitum. [Lat.] Beyond what is allowable.

Una voce. [Lat.] With one voice; unanimously.

Uno animo. [Lat.] With one mind; unanimously.

Un sot à triple étage. [Fr.] An egregious blockhead.

Usque ad mortem fidelis. [Lat.] Faithful unto death.

Usque ad nauseam. [Lat.] To the point of disgust.

Utile dulci. [Lat.] The useful with the pleasant.

Ut infra. [Lat.] As below.

Ut prosim. [Lat.] That I may do good.

Ut supra. [Lat.] As above stated.

Vade mecum. [Lat.] Go with me; a constant companion.

Væ victis. [Lat.] Woe to the vanquished.

Vale. [Lat.] Farewell.

Valet de chambre. [Fr.] An attendant; a footman.

Varium et mutabile semper fœmina. [Lat.] An ever changeful and capricious thing is woman.

Vaurien. [Fr.] A worthless fellow.

Velis et remis. [Lat.] With sails and oars; by every possible means.

Veni, vidi, vici. [Lat.] I came, I saw, I conquered.

Venue. [Fr.] Arrival; coming; advent.

Vera pro gratiis. [Lat.] Truth before favor.

Verbatim et literatim. [Lat.] Word for word and letter for letter.

Verbum sat sapienti. [Lat.] A word is enough for a wise man.

Veritas odium parit. [Lat.] Truth often causes hatred.

Veritas prævalebit. [Lat.] Truth will prevail.

Vamos. [Sp.] Let us go.

Virtu. [It.] Curious or fine.

Verbi gratia. [Lat.] For example.

Voilà une autre chose. [Fr.] That is quite another thing.

Vox et præterea nihil. [Lat.] Voice and nothing besides; sound without sense; nothing but wind.

Vous y perdrez vos pas. [Fr.] You will there lose your steps; you will have your labor for your pains.

Veluti in speculum. [Lat.] Even as in a looking-glass.

Veritas vincit. [Lat.] Truth conquers.

Vérité sans peur. [Fr.] Truth without fear.

Versus. [Lat.] Against; toward.

Viâ. [Lat.] By the way of.

Via media. [Lat.] A middle course.

Vice. [Lat.] In the place of.

Vice versâ. [Lat.] The terms being exchanged.

Videlicet. [Lat.] To wit; namely; — usually abbreviated to *viz.*

Vide et crede. [Lat.] See and believe.

Vide ut supra. [Lat.] See what is stated above.

Vi et armis. [Lat.] By force and arms; by main force.

Vif. [Fr.] Vivid; intense; lively.

Vigilate et orate. [Lat.] Watch and pray.

Vin. [Fr.] Wine.

Vincit omnia veritas. [Lat.] Truth conquers all things.

Vincit qui patitur. [Lat.] He conquers who endures or bears.

Vinculum matrimonii. [Lat.] The bond of marriage.

Virtute officii. [Lat.] By virtue of office.

Virtutis amore. [Lat.] From love of virtue.

Virtutis fortuna comes. [Lat.] Good fortune is the companion of virtue or courage.

Vis à vis. [Fr.] Opposite. face to face.

Vis inertiæ. [Lat.] The power of inertia; resistance.

Vis vitæ. [Lat.] The vigor of life.

Vitiis nemo sine nascitur. [Lat.] No one is born without faults.

Vivat. [Fr.] A shout of "Long live."

Vivâ voce. [Lat.] By the living voice; by oral testimony.

Vive la république. [Fr.] Long live the republic.

Vive la bagatelle. [Fr.] Success to trifling.

Vive, vale. [Lat.] Farewell and be happy.

Violà. [Fr.] Behold; there is, or there are.

Voilà tout. [Fr.] That's all.

Volens et potens. [Lat.] Willing and able; — the motto of Nevada.

Volente Deo. [Lat.] God willing.

Volo, non valeo. [Lat.] I am willing, but unable.

Votum castitatis. [Lat.] A vow of chastity.

Vous y perdrez vos pas. [Fr.] You will lose your labor.

Vox populi, vox Dei. [Lat.] The voice of the people is the voice of God.

Vulgò. [Lat.] Commonly.

Vulnus immedicabile. [Lat.] An irreparable injury.

Vultus est index animi. [Lat.] The face is the index of the mind.

Venalis populus, venalis curia patrum. [Lat.] The people are venal, and the senate is equally venal.

Ventis secundis. [Lat.] With favorable winds.

Veniunt a dote sagittæ. [Lat.] The arrows, or incitements to love, come from the dower.

Vereor ne. [Lat.] I fear he will.

Vereor ut. [Lat.] I fear he won't.

Voir le dessous des cartes. [Lat.] To see the faces of the cards; to be in the secret.

Ventre affamé n'a point d'oreilles. [Fr.] An empty stomach distracts the mind; a hungry person has no ears for explanations.

Practical and Artistic Penmanship, Taught and Practiced by

H. W. SHAYLOR.

> "Whence did this wondrous, mystic art arise,
> Of painting speech and speaking to the eyes;
> That we, by tracing magic lines, are taught
> How both to color and embody thought?"

WHENCE it came, what its nature and value, and whither its development tends, are questions that often occur to the thinking mind. To trace it back, seeking for its origin, would very soon lead to mysterious paths, and only prove more vexatious because of time lost and no definite results attained. There are many theories, all based on imperfect and often unreliable records, so obscure and conflicting that the actual knowledge to be gained does not compensate for the time spent in sifting them.

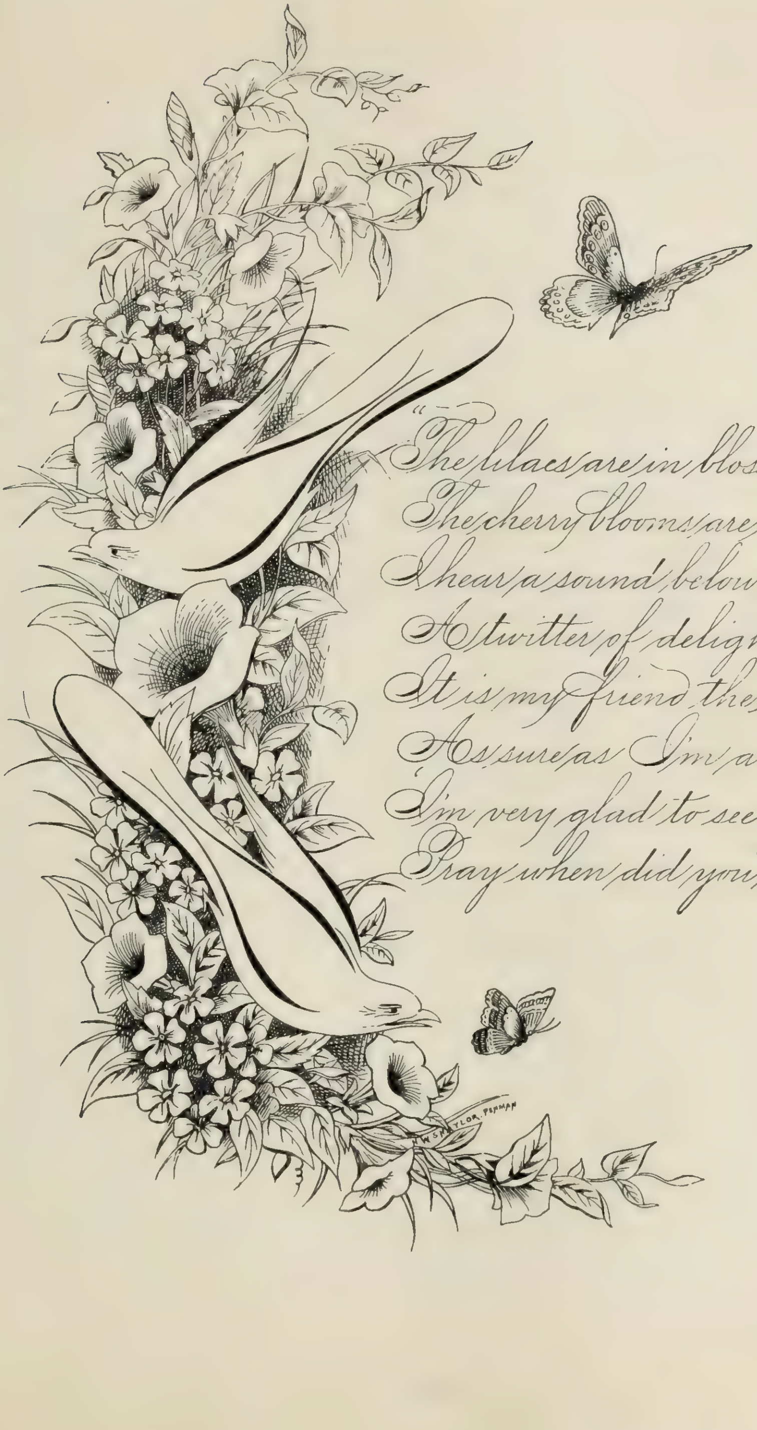
Its practical value is obvious, and its acquisition is palpably a matter of the greatest importance to every one, no matter in what condition of life. As has been well said, it is "the record of the past, the regulator of the future, the soul of commerce, and the messenger of thought." Without a knowledge of this art the events of history would have been entirely dependent on traditionary descent, and much, therefore, of great value lost beyond hope of recovery. Not only this, but almost endless litigation must of necessity ensue because of the fickleness of men's memories.

It is indeed the very soul of commerce, recording not only what is of present use, but what in time to come may be of priceless value. As a vehicle of thought between man and man, in business as well as social relations, who can estimate its importance?

Through the medium of the pen, missives of love, sympathy, and condolence, cementing friendships and reviving pleasant memories, traverse continents and make voyages to every quarter of the globe.

That style of penmanship which can be rapidly written — combining the fewest lines in a given form to make plain the writer's meaning, and at the same time make neat work — is certain to be the popular style in the near future. No country in the world, at the present time, can boast of so many and so fine penmen as our own, and nowhere is the art more thoroughly taught, as it has been made a branch of common education to such an extent that poor writers are fast becoming the exception.

The organization of commercial colleges throughout our country gave an impetus to this art as a branch of education, that helped to place it at once high in importance in the estimation of the business community; so that now no young man can consider his educa-



"The lilacs are in blossom;
The cherry blooms are white!
I hear a sound below me,
A twitter of delight.
It is my friend the robin
As sure as I'm alive!
I'm very glad to see you.
Pray when did you arrive?"

tion complete, nor himself fully equipped for business, unless he can write an easy, rapid, and legible hand.

How to acquire a good handwriting is, then, the question which naturally arises. Most people admire good penmanship and would like to write well, but it seems to them that their case is hopeless, — that only those who are gifted by nature with a genius for such work can ever succeed.

While all must admit that persons possessing this natural genius will succeed much better, it is mainly because the inherent love impels them to devote more time to its cultivation; for no one, without great labor and careful painstaking, in addition to natural ability, should ever expect success in any art or science. And this is what is lost sight of or not fully comprehended by all who claim that success is possible only to those possessed of native talent. They seem to have gained the impression that to be thus endowed is the only thing necessary to an accomplishment, while in fact it is simply the foundation on which attainment can be reached, and that only by hard work. We claim that nine persons in every ten, no matter what the natural bent of their mind may be, can become, by careful practice, what the majority of people would term "excellent penmen."

We say by careful practice, and we mean just this: First, that you have before you a good copy; next, that you select suitable material, and then practise, carefully noting the analysis of the letters, the principles which enter into their construction, — in a word, practise intelligently, criticising your work frequently by comparison with the copy. Do this persistently, patiently, and perseveringly, and your success is assured.

MATERIALS. — Good materials are as essential to good work as pure air to health. Select the best of paper, pens, and ink, and you will not only find them cheapest in the end, but will save much time and annoyance, as well as disappointment; for you will certainly fail to secure creditable work with poor materials, and therefore will be disappointed and discouraged.

PAPER. — In selecting paper, choose that which has a good finish; not too glossy, but smooth and well sized, so that the ink will not spread, and of such weight that you can easily write on both sides without heavy lines showing through. Always have at least half a dozen sheets under the one on which you are writing, to present a smooth surface and to make it slightly flexible. Sometimes it is well, in addition to your regular practice paper, which should be of letter or cap size, to have a few additional sheets of very thin but extra quality of unruled linen paper, — the thinner and more transparent the better, — to be used as follows: Place it over the copy and trace to fix the form definitely in the mind; also trace with a free movement, in the same manner, some of the movement exercises. It is well, also, to *write* your copy occasionally on this paper, and then place it over your engraved copy and compare, thus enabling you to determine more easily just where your faults lie.

PENS. — The pen for general practice should be of medium size, fine point, and quite elastic. A good steel pen is preferable to a gold pen in one respect, which is that ink will generally flow more readily from it; still, a steel pen will last but a day or two, perhaps less, while a gold pen, with proper care, will last for months. Amalgam and cheap pens in imitation of gold are worthless for practice, and should be discarded. For lettering or pen drawing, a pen with an extra fine point should be used. Penmen who are accustomed to all kinds of ornamental work will of course require a variety of fine and coarse pens. In the Old English and German Text alphabets a quill pen is generally used, the point being made broad or fine to suit the width of the required letter. Turkey quills are preferred to those from the goose, on account of being thicker and harder, no elasticity being required. Probably Gillott's No. 604 extra fine pen would suit a greater number of persons than any other. For ladies' hand one still finer might be desired, when No. 303 of the same manufacture would be more suitable. There are many American pens made in imitation of these, but none that we have ever tried equal them in any of the desired qualities, except durability.

PENHOLDER. — The penholder should be of a size convenient to be held, — plain, and not over six or seven inches in length. The majority of the most proficient penmen prefer what is known as the "oblique" penholder, — one which has a metal attachment at the end for holding the pen at an angle corresponding with the slope of the letter, thus bringing both nibs to the paper more evenly. Any pen may be used with this holder. It is especially desirable in practising whole-arm capitals, as smoother shading can be done with it than with the ordinary straight holder.

INK. — Professional penmen use what is known as Japan ink, — Walkden's or Arnold's is equal to any in the market. In using either, it is generally better to dilute with Arnold's fluid, so that the ink will flow more readily. When the Japan ink is first opened, it will appear somewhat pale, but if exposed to the air for a few days will become a deep, rich black. When it thickens, as it will upon the evaporation of the water in it, add a little of the fluid, or even a little tea will do if the fluid is not at hand. The chief objection to this ink for every-day practice is that if used very black it does not flow so readily as many would like.

For the benefit of any who cannot easily obtain this ink, we herewith give a formula, by following which you may be able to prepare a very good substitute for the Japan ink: —

Black Writing Ink. — In six quarts of water boil four ounces of logwood in chips, cut very thin across the grain. The boiling may be continued for nearly an hour, adding from time to time a little boiling water to compensate for the waste by evaporation. Strain the liquor while hot, allow it to cool, and make up the quantity equal to five quarts by the further addition of cold water. To this decoction add by mixing, till it forms a smooth paste, half an ounce acetate of copper; one pound blue galls, coarsely bruised; four ounces sulphate of iron, calcined to whiteness; three ounces coarse sugar; six ounces gum arabic.

As mentioned before, this has one objectionable feature as an ink for common practice, — it does not flow readily; and we give below a simpler recipe, for

Blue Ink. — Take sulphate of indigo, dilute it with water till it produces the desired shade, and add a little gum arabic to hold the solution.

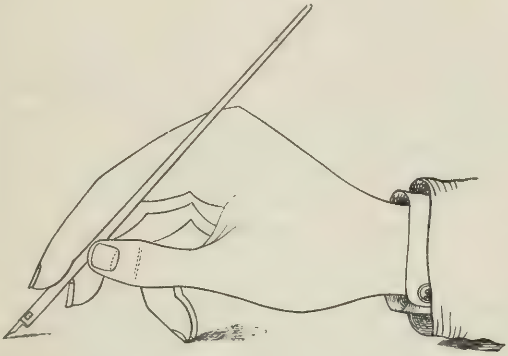
For a very cheap ink, the above, or even common bluing, such as is used for bluing clothes, with a little gum added, will make an ink that is always ready, and for practice on paper that is not to be preserved will answer very well. Of course, for any writing that is to be permanent, use nothing but a pure black nut-gall ink.

In pen drawing and delicate shading, India ink is used. This comes in cakes of different sizes and quality. It is prepared by pouring a little water in a shallow dish and rubbing the cake till the desired shade is produced. The very best and blackest of ink may be made from it. The faint and delicate shading often seen in pen drawing is executed with ink thus prepared, as any shade may be obtained, from the least tint to a deep black.

PEN-WIPER. — The best pen-wiper is a wet sponge. Procure a small, soft sponge, place it in a small tumbler or similar dish and fill with water. This should be kept constantly by your side. It has this advantage over other pen-wipers commonly used: it always cleans the pen well, and leaves it damp, so that the ink will flow from it readily. In using chamois, the point of the pen is often left oily, and the ink will not flow readily from it when renewed. Common woollen pen-wipers often leave a piece of lint between the points of the pen, and the next stroke will be spoiled.

Position. — Having given proper attention to the selection of your materials, you are now ready to begin work. It is of the greatest importance, especially if you intend to make writing a business, or are required to write much, that you should assume a healthful position of the body, — one that will admit of free, easy motions.

Take a position directly fronting the desk, keeping both sides equally distant from it, never resting against it. Sit erect, with the feet squarely on the floor; avoid dropping the body into an awkward, tiresome position. Support and steady the body with the left hand, so that the right will be perfectly free. The right arm should be placed at right angles to the ruled lines on which you are writing, the left arm parallel to these lines. The eyes should be at least twelve inches from your writing. If a person were required to write all day, a change of position to that with the right side to the desk, or to a standing attitude, would be advisable for a part of the time.



Pen Holding. — Take the pen between the first and second fingers and thumb, the penholder crossing the hand just forward of the knuckle joint of the forefinger, and crossing the second finger at the root of the nail. Place the thumb against the holder opposite the first joint of the forefinger, with just enough pressure to hold the pen in position. The third and fourth fingers should be drawn back to form a rest for the hand, just touching the back of the nails. This is called the hand rest. The second and third fingers should separate at the second joint. The penholder should be held at an angle of forty-five degrees, the top of it pointing toward the right shoulder.

The penholder should never be grasped so firmly as to make the hand ache, and the third and fourth fingers should always form a movable rest, so that the muscles of the arm and wrist be not strained. The cause of pain in the hand and wrist, to those unaccustomed to writing, is due to a violation of one or both of the above cautions; that is, either the pen is held too firmly, or the hand does not move from left to right on the fingers, but they remain stationary, and the writer attempts to reach as far as he can without lifting the pen, thus straining the muscles of the wrist and arm. This leads us to a consideration of one of the most neglected and yet most important of all the fundamental principles governing good penmanship. Execution is everything, and that depends on good

Movement, without which no one can ever hope to write either easily, gracefully, or rapidly. One of the greatest difficulties to overcome in acquiring a good handwriting lies here. There are two rests in writing, one on the arm near the elbow, called the *Arm Rest;* and one on the fingers, called the *Hand Rest.* On this latter rest the hand should slide from left to right in the formation of every letter, not only from left to right, but partially in every direction which the pen takes. If the fingers should leave a tracing of their course, it would seem to correspond nearly with the course of the pen, shown in the forms of the letters produced. There would be this difference, however: the pen produces the exact form; the finger would move as far to the right, but the upward strokes would be very much shorter, so that their course would be more zigzag. The reason is obvious: the longer letters would naturally be formed partially by the contraction and extension of the first and second fingers and thumb, which, united with the arm or lateral movement, would produce a zigzag line.

Neither the right side of the hand nor the wrist should ever touch the desk. If the arm be placed in position to write, and remain stationary on the two rests, letters can be formed by extending and contracting the fingers and thumb, which in writing is known as the *finger movement.* Should the fingers and thumb remain in one position, — *i. e.*, without extending or contracting, — and an attempt be made to write by sliding on the hand rest, we should call it the *muscular*, *forearm*, or *lateral* movement.

Should the *muscular* and *finger* movements be united, as above mentioned, and letters formed by moving the hand to the right, and at the same time extending and contracting the fingers, it would be called and is known as the *combined* movement; and it is *the* movement for all practical business purposes.

EXERCISES. — By reference to the movement exercises, you will see something of the order of practice necessary to develop a free movement. Commencing with exercise No. 1, you will allow the hand to slide from left to right, and back to left again, repeating the motion from ten to twenty times, with a steady, uniform movement, about in time with the swinging of a pendulum. The length of the line may be varied, beginning with a line one inch in length and increasing to three or even four inches.

This should be followed after a few minutes by practice on exercise No. 2, and so on in succession from lesson to lesson, until any of them can be easily executed without raising the pen. At least five minutes should be devoted to these movement exercises before each lesson.

While any one of them would be profitable at any time, and would be always in order, it would be well to take part of the five minutes for practice on the one bearing directly on the lesson of the day; *e. g.*, if the capital A were the principal letter in the lesson before you, then the movement exercise on the capital stem would be the proper one to precede the lesson.

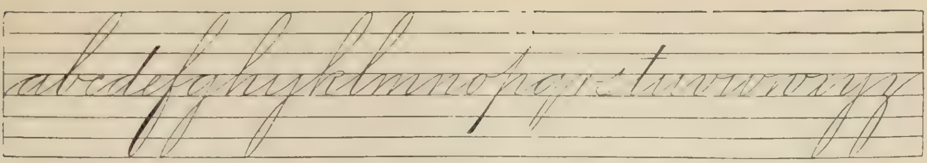
Practice on these exercises or on any letter should never be allowed to degenerate into mere scrawling. The best results can only be attained by patient and persevering care. Remember that "whatever is worth doing at all is worth doing well"; also, while practising on what may seem to be merely abstract forms and of no practical value, remember that these are of the utmost importance in gaining ease and freedom: for

"True ease in writing comes from art, not chance,
As those move easiest who have learned to dance."

LEGIBILITY is of necessity the first and primary requisite in penmanship; everything must be subservient to it. There are other things of importance, but legibility must stand at the head of the list when the essential features are considered.

There are many things which contribute to legibility, and some of those things need especial attention. The elements which enter into the construction of letters, the forms of the written alphabet, both capital and small, the rules which govern the combining of letters into words, those which regulate the arranging of words into sentences, together with the size, slant, etc., will be duly considered under their proper heads.

If to legibility can be added beauty, so much the more desirable would such an accomplishment seem; but it must take a secondary place. For correspondence and epistolary writing, more elaborate and ornamental forms may be used. For business purposes, however, it is necessary that all superfluous work in the way of flourishes or non-essential lines be dispensed with; in fact, they not only require time, but there is danger of obscuring the shape of the characters.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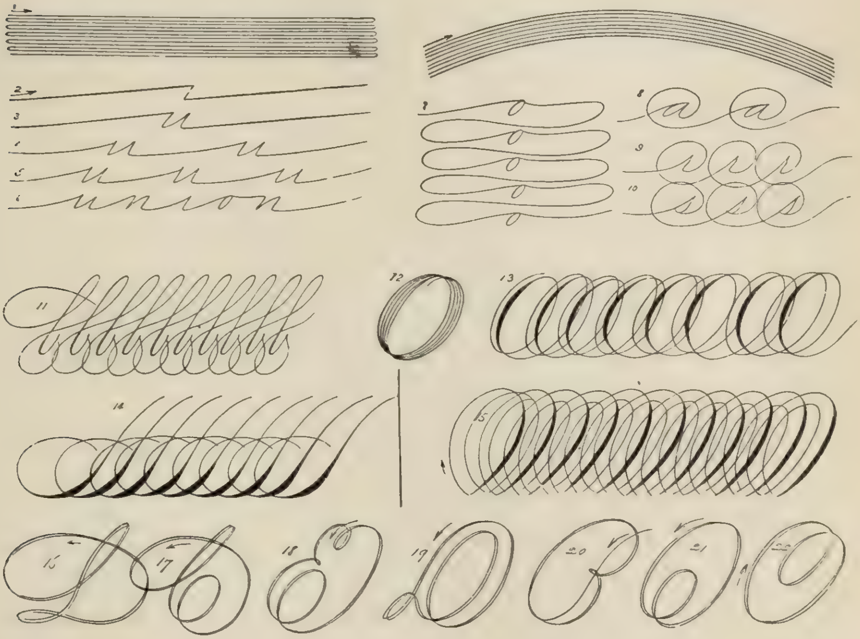
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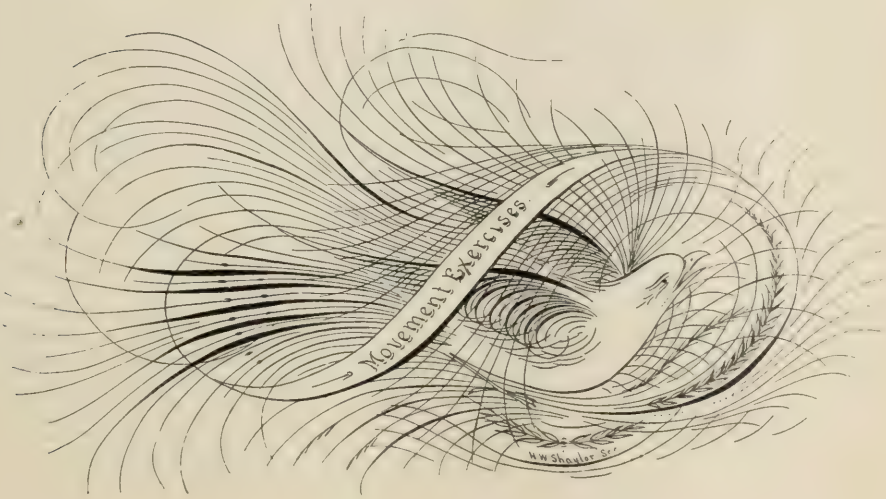

Movement Exercises
H.W. Shaylor Sc.

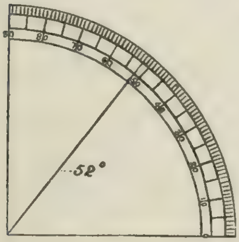
We should place second on the list, as one of the essentials, RAPIDITY. As we have before stated, without good movement rapid writing is out of the question, if we would still preserve legibility. To keep pace with all the advancements of commerce, through the developments of science, it is absolutely necessary that rapidity in writing shall stand among the foremost of its features, otherwise it will have to give way to some other method to be developed hereafter, to meet the pressing demands of this progressive age.

Some of the other things which demand attention, as contributing to the legibility of chirography, may be considered under the heads of SIZE, SLANT, SPACING, etc.

SIZE. — For ordinary business purposes, short letters should not exceed one tenth of an inch in height; a much finer hand would conduce to rapidity. The alphabet of small letters are written to a scale nearly as follows: All of the short letters, as *a, c, e, i, m, n, o, u, v, w, x,* together with the finishing parts of some others, as small *h* and *p,* etc., are one *space* in height. This space may be more or less; but as we have said, not far from one tenth of an inch for business writing. This being settled, it becomes the standard of measurement for the other letters in regulating their size. If we include small *r* and *s* in the list of short letters, we have thirteen, or half of the alphabet. Small *t* and *d* are usually written twice as high, or two spaces; and the loop letters, as *h, k, l,* etc., are written three times as high, or three spaces; while *j, y,* etc., extending below the line two spaces, make the entire scale five spaces.

This scale is made to consist of seven spaces for a lady's hand, by increasing the length of the loops one space above and one below the short letters. By reference to the plate this will be made plain.

SLANT. — Uniformity in the slope of all corresponding strokes not only renders writing much more pleasing to the eye, but adds to its legibility. Inattention to this matter in a piece of penmanship is as painful to the eye as discord in music is to the sensitive ear.



All of the downward strokes in small letters which are straight should have the same slope; and in all of the small letters except *o, e, c,* and *s,* there is at least one straight line. By holding the hand at right angles to the line on which we write, as before spoken of, we make these strokes not far from an angle of 50° from the horizontal; 52° has generally been considered the slant about right to be easily written and to look well, and is termed the *regular slant.*

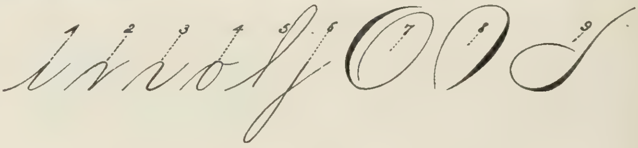
In order to test work, the cut can be consulted, or a similar diagram constructed, which is easily done, as follows: With a pair of compasses draw a quarter of a circle on a piece of card-board. In a quadrant there are 90°; divide the arc into nine equal parts and number them, as in the accompanying diagram, from 0 to 90. Divide the space between 50° and 60° into ten equal parts, and from 52° draw a heavy line to the angle, or intersection of the vertical with the horizontal line.

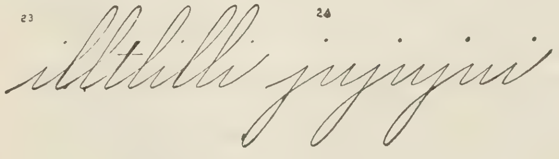
Make the horizontal, as well as the slanting, line very black, and then let the sheet of paper be placed over it, and unless the paper be very thick, the downward strokes can be seen plainly enough to be compared with the proper slant, and so correct all mistakes. If the paper be too thick to be looked through, the diagram can be drawn on very thin, tough paper and placed over the writing. Of course, in either case, have the horizontal line of the diagram coincide with the ruled lines on the paper. The slant of the upward strokes will take care of themselves if proper attention be given to

SPACING, which also should be uniform. We have said the small *i*, or small letters, may be used as a standard of measurement, the height of which is one space or one tenth of an inch. The distance between letters in a word is one space, or equal to the height of the small letters. This is the measure, taken horizontally at the top of the short letters. The following exceptions may be noted: When the letters are connected by a double or compound curve, as between *i* and *n* in the word "in," the distance may be slightly increased. Between *a*, *d*, *g*, and *q*, the distance is one space greater.

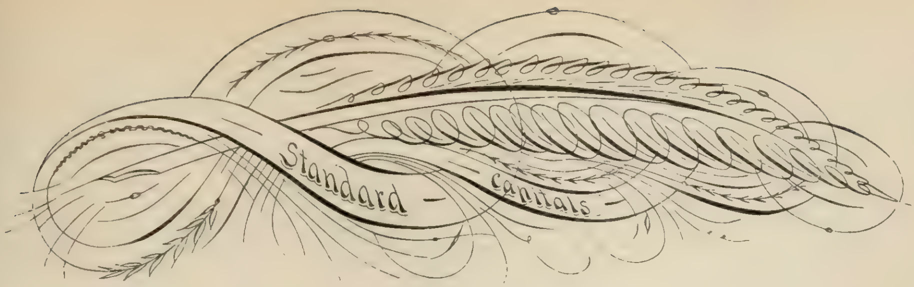
Words in a sentence should be so spaced that the initial stroke of each word shall begin vertically under the terminal stroke of the one which immediately precedes it. Between sentences increase the distance at least one space. Careful attention to spacing will soon enable one to secure uniform distance from force of habit.

We come now to an analysis of the letters of the alphabet. Before a person can practise intelligently, it is necessary that he understand the component parts of letters. As early as one hundred years ago, the alphabet was analyzed and separated into its component parts, called *principal strokes*, from six of which all the small letters and part of the capital letters were formed. These six strokes, with two or three additional ones, were all that were considered under the head of elementary parts. Since that time, various authors have modified some of the forms and given them different names, but not always in the way of actual improvement. To even the superficial observer there are some few elements or parts of letters which are common to a large number of the letters of the alphabet; as, for instance, the last part of small *n*. It is found in the following letters, viz., *h*, *m*, *n*, *p*, *v*, *x*, *y*, and but slightly modified and enlarged for the first part of capitals *V*, *U*, *Y*. Take these elements as they stand to-day, and we have the following nine parts, from which, with but slight modification, all the letters may still be formed.





Not less than six of these remain as they were used by JENKINS in a work published in 1785, although not numbered the same. In order to simplify the matter as much as possible, some authors have



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O O E D C C H H W Q

A Z W L V U Y N M J

A N M T F H K G S

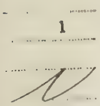
S L P B R P B R V Z A

A A R M Y P B R N W J

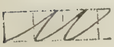
taken the simple curves, as the first part of small *i* and *n*, and called them *principles.* While this does simplify in one way, it really seems too much of an analysis, and obstructs rather than assists the learner in his attempts to practise on parts of the letters before taking them as a whole.

Taking the letters, then, in the order in which they are based on these Principal Parts or Principles, they naturally arrange themselves into groups. We shall consider them in this order.

First Principle or small *i* is formed from three lines or strokes, two upward and one downward. The first upward line is slightly curved, and unites in an angle at the top with the straight line, which descends at the regular slant almost to the line, when it turns short to the right, uniting with the finishing stroke, which is exactly like the beginning. This curve terminates one space to the right from the top of the letter; the distance between the beginning point and that where the straight line touches the lower line is also one space. The height of this principle is one space, width two and one half spaces, measured between vertical lines.

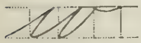


Small *u* is the next following small *i*, and is simply the first principle repeated. Height, one space; width, three and one half spaces. In connection with the practice on this letter, as well as small *i*, practise faithfully on movement exercises Nos. 2, 3, 4, and 5.

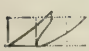


In both of these letters, care should be exercised to make the down strokes uniform in slant, to turn them alike at the bottom, and to have all the upward strokes curve alike.

Small *w* is also formed from the first principle repeated: the last part or third upward curve is brought up half a space to the right and joined in an angle to another similar curve, made in a horizontal position, and one space long. Height, one space; width, four spaces. The same movement exercises as for small *i* may be used.

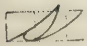


Small *t* is formed from the first principle, modified by extending the first upward stroke a little higher and joining the straight line by a short curve, and finishing same as small *i*. Height, one and one fourth spaces; width, two and one half spaces. Movement exercises Nos. 2 and 9.

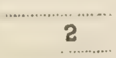


Avoid making the letter too wide at the top, or too high, both of which are common mistakes in forming this letter.

Small *d* is usually arranged to follow *t*, and grouped with it, not only because of height, but because the beginning and finishing curves are alike in each. The downward stroke is really like Principle 9 on a small scale, and terminating with a dot on the ascending curve, about one fourth of a space above the ruled line. Height, one and one fourth spaces; width, two and one half spaces, full.



The difficulties to be met with in its construction are in making the letter too wide or too narrow, and in failing to bring the second curve back to touch the first curve, thus leaving the letter open at the line. Practise on exercise No. 10.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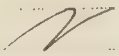
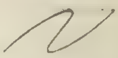
Second Principle is simply the first principle inverted, same height and width.

3

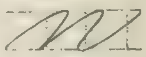


Third Principle begins like the second and finishes like the first principle, thus making a turn at the top and bottom. Height, one space; width, two and one half spaces.

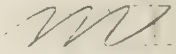


We have given these two parts in succession because both of them are used together in *n* and *m*, and also because none of the letters are formed either from the second alone or first and second combined, except one style of small *x*.

Small *n* is formed by a combination of the second and third principles. These two are joined so that the distance between the down strokes is one space; height of letter, one space; width, three and one half spaces.

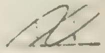


Small *m* may be formed by prefixing another second principle to the small *n*, or by combining two second principles with the third, retaining one space between the downward strokes. Height, one space; width, four and one half spaces.



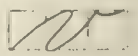
The movement exercises for *n* and *m* most suitable would be Nos. 3 and 4 inverted.

Small *x* is made in two ways, either of which may be used. The better way, we think, is to make the first half of *x* with the second principle, modified by slightly curving the downward stroke; to this join the first principle, modified in the same way and just touching at the centre of the letter.



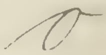
The other mode of construction is to begin with the third principle, and finish by crossing this at the middle of the straight line by a straight line drawn upward at an increased slant. The object in drawing it upward is to secure a fine line. Height, one space; width, about two and three fourths spaces.

Small *v* is formed by beginning with the third principle and terminating like *w*. Height, one space; width, two and three fourths spaces.



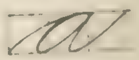
Fourth Principle, or small *o*, is begun like the second principle, with a slight curved line joining in an angle at the top with another similar curve at the regular slant, which turns at the bottom and unites with an opposite curve like *v*, with the difference of curving more and closing at the top. The finishing curve is like *v*. Height, one space; width, two and three fourths spaces.

4



Practise on exercise No. 7 in connection with this letter. Avoid making straight lines instead of curved lines, and do not fail to close the letter at the top, otherwise it might be mistaken for *v*.

Small *a* is formed from a combination of a modified fourth principle to which the first principle is added. The modification consists in increasing the slope of the

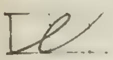


oval, curving the downward stroke more, and making the oval part more pointed at the top. Height of letter, one space; width, three spaces.

Practise movement exercise No. 8.

From this modification of the fourth principle the left-hand part of *a, d, g,* and *q* is formed.

Small *e* is formed partly from the first and partly from the fourth principles; the upward

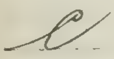


strokes are like *i*, save that the first one curves more, while the downward is like small *c*.

The downward stroke crosses the first curve at one third the height of letter from line, the width of the loop not over one third of one space. Height of letter, one space; width, two and three fourths spaces.

This letter may be practised as a movement exercise simply by repeating the letter several times, and making the distance between each letter from one half to one inch, similar to exercise No. 4. Be careful in its construction not to make the loop too wide by curving the downward stroke too much.

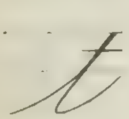
Small *r* combines the same principles as the preceding letter, with the addition of a



reduced form of the first principle at the upper extremity of the first stroke, the straight part of which should not exceed one fourth of one space in length. Height of letter, one space; width, two and three fourths spaces. The same caution is to be given as for *e*, and the movement exercise may be similar.

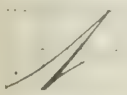
This includes all of the letters one space high, or those generally classed as *short* or *contracted* letters. We now consider those next higher, called the *short extended;* and in this class the four following letters are usually grouped, viz., *t, d, p, q.*

Small *t* is simply the first principle with the straight part extended one space above and



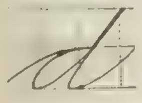
shaded. The upward stroke is nearly straight in the upper half, and the downward stroke retraces the first half its length. The crossing line of *t* should be made half a space from the top and about one space long. Height, two spaces; width, two and one half spaces. The second stroke of this letter is shaded by a full pressure at the top, and gradually diminishing toward the line.

In addition to this style we have another, used when it terminates a word. This is



formed by beginning with the first principle extended to two spaces in height, and terminating with the finishing curve of the second principle, which serves also as a crossing line, thus completing the letter without lifting the pen. Owing to its liability to be confounded with other letters, its use should be avoided. Height and width same as first style. The shade is nearly the reverse of the first, or as in small *p*, which see.

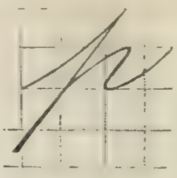
Small *d* combines the modified fourth principle as used in *a* with the modified first



as used in *t*, or is simply a compound of *a* and *t*. Height, two spaces; width, three and one half spaces. Shade as in first *t*.

This letter is often faultily made through failing to note that the last downward stroke retraces the upward half its length, thus leaving it open nearly or quite to the top, making the letter much too wide at its base and destroying the slant of the whole letter.

Small *p* begins like the termination with the first principle extended two spaces, and with the downward stroke of this principle continuing below the line one and one half spaces. Raise the pen, and beginning back at the line, join the third principle to the first part, making both downward strokes at the same slant.

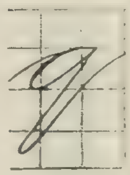


The first downward stroke always receives a shade by beginning at the line and gradually increasing the pressure to the end, when the pen should be raised quickly in order to make a smooth and square termination. Length above line, two spaces; below line, one and one half spaces; extreme length, three and one half spaces; width, three and one half spaces.

Common faults: First, making the long stroke with too much slant, and then trying to remedy it by making the last part too nearly vertical; second, making it too long below the line and drawing the shade off in a tapering manner. It is well to take the first half of this letter and practise it separately, increasing its length to double the height commonly required.

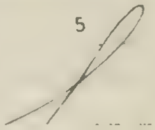
In forming this letter, if you note that the lower end of the second line terminates at a point vertically under the point of beginning the letter, it will assist you in regulating the slant.

Small *q* begins with the modified fourth principle joined to the first principle, which is also modified by extending the straight line downward one and one half spaces below the line, then turning to the right and extending upward nearly parallel to the downward stroke till it reaches the line, when it curves outward, terminating one space to the right from the top of the pointed oval. Length, two and one half spaces; width, three and one half spaces.



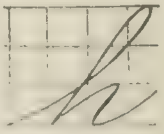
The next class of letters in order is that known as the *extended* or *loop letters*, based on Principles 5 and 6.

Fifth Principle is a loop three spaces in height, the first curve beginning like small *e*, extending upward through three spaces, and uniting in a turn at the top with the downward stroke, which curves slightly for about one space, when it gradually merges into a straight line which crosses the first curve at the height of the short letters, or one space from the line. Height, three spaces; width, three spaces; width of loop, not quite half a space.

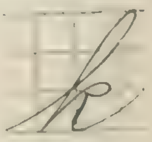


Practise this principle separately a great deal in connection with exercise No. 23 before attempting to form any of the letters based upon it.

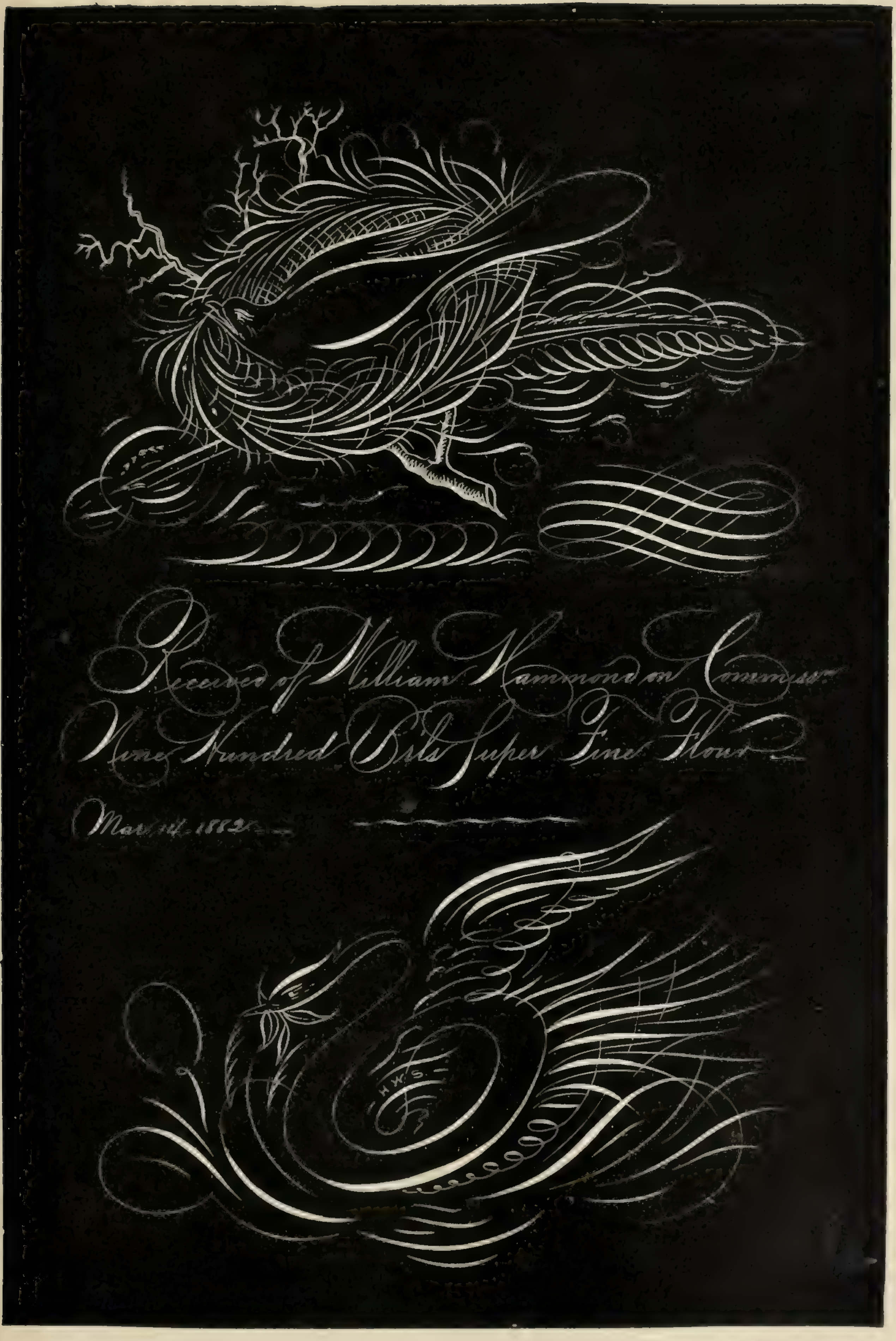
Small *h* is formed from the fifth principle united at the bottom to the third. Height, three spaces; width, three and one half spaces.



Small *k*, like *h*, begins with the fifth principle, and unites at the base with the first curve of the second principle, which extends upward one fourth of a space above the line, curving full to the right and downward below the line one fourth of a space, and back to the left half a space, where it unites in an angle to the third principle. Height, three spaces; width, three spaces.

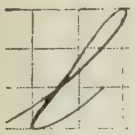


Be careful to make the last downward stroke slant to correspond with the long stroke.

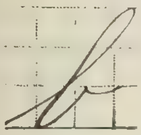


Received of William Hammond on Commissn
Nine Hundred Bbls Super Fine Flour

Mar 14. 1882

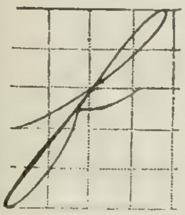


Small *l* is formed from the fifth principle terminating like the first. This letter is sometimes shaded slightly from the middle downward nearly to the line. Height, three spaces; width, three spaces. You will observe the lower part of this letter is precisely like small *i*, and the same movement exercise, together with No. 11, would be beneficial to practise in connection with it.



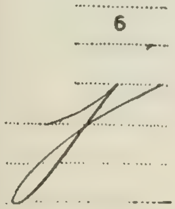
Small *b*, like *l*, begins with the fifth principle, terminating like *v* or *w*, with half a space between the parts at one space from the line. Height, three spaces; width, three and one half spaces.

The faults likely to be found in the construction of this letter, as in *l*, are making the downward stroke curve too much (thus making irregular spacing when in a word), as well as making it too broad at the base. Exercise movement No. 11, with this and all of the loop letters above the line, would be profitable.



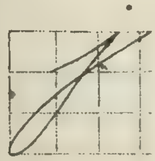
Small *f* is also formed from the fifth principle, the straight line of which is continued downward below the line nearly two spaces, when it curves gradually and turns to the right, uniting with a curve similar to the finish of *b*, with this difference, however, that the curve gradually approaches the straight part, and touches at the middle of the letter, or half a space above the line, where it unites in an angle to a curve which terminates as in small *i*. Height above the line, three spaces; length below, two spaces,—making extreme length five spaces; width, four spaces.

Be careful to make the downward stroke quite straight, and upper and lower loops equal in width.



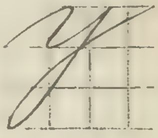
Sixth Principle is simply the fifth inverted. The straight line being formed first renders it necessary to give especial attention to it, and it is worthy of being considered as a distinct principle as much as the second, which is an inverted first principle.

Practice on this principle separately, as with Principle 5, is recommended; also on exercise No. 24.

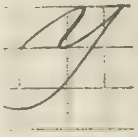


Small *j* is formed directly from the sixth principle; the only addition is to prefix a curve as in the beginning of the first principle. This letter is completed with a dot as in small *i*. Length of the letter, three spaces, two of which are below the line; width, three spaces.

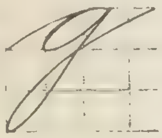
Note that in all the letters formed from this principle, the last upward stroke crosses at the line. The only exception to this is when small *e* or *s* follows the loop, in which case to cross a trifle below the line may be advisable. Attention should also be given to making the downward stroke at the regular slant, as letters of this class, especially when they terminate long words, are often increased so much in slant as to destroy the beauty of the writing. As a means of obviating this difficulty, and also on account of being more quickly made, the small y and g are often abbreviated, as you may see by reference to those letters.

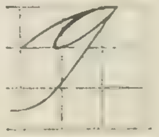


Small y is simply an inverted h, beginning with the third principle and terminating with the sixth. Length, three and one half spaces; width, three spaces. Be careful to make the first part of y turn at the top, as a natural tendency is to make it begin with the first principle, which renders it liable to be mistaken for i and j combined.

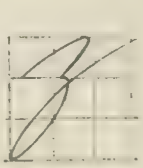


The abbreviated or business y is often used as a terminating letter, on account of being easily and rapidly constructed, and also, as suggested above, less liable to be spoiled by improper slant. The first half of the letter is like the regular y, the last half being continued down straight one space below the line, when it merges into a curved line extending down and to the left half a space more. Length, two and one half spaces; width, two and one half spaces.





Small g unites the modification of the fourth principle as used in the left of a and d with the sixth principle as in y. Length, three spaces; width, three and one half spaces. We have also the abbreviated or business g, corresponding exactly with the y in its finish, and used in the same manner.



Small z begins with the second principle, at the base of which, joined in an angle, is a modified sixth principle,—the change consisting in curving the downward stroke somewhat abruptly to the right, and continuing down through the two spaces, as a curve, no part of the lower section of the letter being straight as in the sixth principle; the upward finishing stroke, however, being like y or g. Height, three spaces; width, three spaces.

FIGURES.

To execute good figures in a rapid manner requires quite as much practice on each one separately as for most of the small letters of the alphabet. On the importance of making good, clear figures, no argument need be advanced, as it is conceded by all; we therefore deem the space devoted to them as well used as that given to the analysis of any of the letters, either large or small.

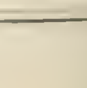


Figure 1 is a simple straight line made at the regular slant, one and one third spaces in height, usually slightly shaded from the middle down to the line.

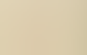


Figure 2 begins above the line about one and one third spaces, with a slight curve downward one third of a space, when it unites, by turning to the left, with an opposite curve extending to the full height (which for all figures except 1 is one and one third spaces), where it again joins in a broader turn to a curve similar to the initial one, and extends to the line, gradually increasing in slant; at the line it unites with the reversed curve, forming a loop which terminates about one third of a space above the line.

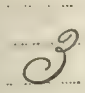


Figure *3* begins like *2,* the upper part being smaller, occupying one third its full height. At this point it joins in a small loop with a full curve which descends to the line, and unites in a broad turn to the left with an opposite curve extending upward half a space, terminating with a small dot.

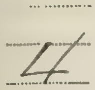


Figure *4* begins at one space from the line, extends downward three fourths of a space with a slight curve, uniting in an angle with a line nearly horizontal and slightly curved, which extends to the right one space.

The second part begins one and one third spaces above the line, curving well in the upper half, and crossing the second line of the *4* at about one third its length from the right end, and continuing to the line quite straight.

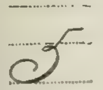


Figure *5* begins at full height, and extending downward with a slight curve to one third its height, unites with a small loop to a part finishing exactly like figure *3.* In *3* and *5* be careful to make the loop small and the upper part short.

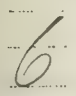


Figure *6* is higher than any of the others, beginning at one and two thirds spaces in height, extending downward with a slight curve nearly to the line, where it curves to the right in a broad turn, extending upward with an opposite curve nearly one space high, again joining in another broad turn to a curve similar to the first, which terminates a little above the line. Make this last curve within one third of its full width from the first downward stroke.

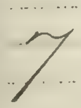


Figure *7* begins at one and one fourth spaces from the line, extending downward one fourth of a space, joining in an angle to a full reversed curve which extends to the right three fourths of a space, where it joins in another angle to a line like figure *1,* which is brought down half a space below the line.

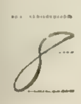


Figure *8* begins at the full height, extending downward to the line with a full reversed curve, where it turns to the left and finishes with a curve like the beginning of *n* to the point of starting, crossing the downward line at three fourths of a space above the line.

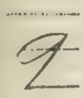
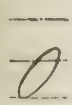


Figure *9* begins at full height, with a pointed oval which is one space long, joining at the top, as in *a,* with a straight line as in *7.* The pointed oval has not quite so much slant as *a,* and the first upward curve usually made in the oval is omitted.



The cipher is simply the fourth principle or small *o,* with the first and last curves omitted. Made at same height as figure *1.*

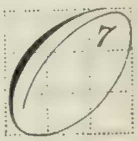
The dollar sign consists of two straight, slanting lines made at regular slant, and crossed by a reversed curve which resembles the italic *S*. The straight lines are made $ same height as figure *6*, and extend below the line the same as figure *7* or *9*. The curve part is one space only in length, and rests on the line.

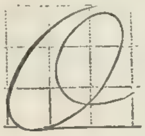
CAPITALS.

By reference to the principles, you will notice there are three only from which all of the capital letters are formed.

The small letters were explained in the order in which they occur as based on the principles, and the same order will be continued in our treatment of the capitals.

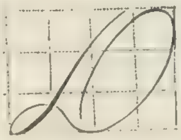
The capital *O* or *Seventh Principle* is formed entirely from curved lines Full height, three spaces; width, three spaces. The distance between the finishing and the beginning curve at the middle height is about one fourth the whole distance across the letter.

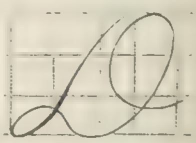




The capital *O* is also formed as here shown, and is called the abbreviated or business form. The last curve in the letter, instead of continuing down to the line before crossing, curves more abruptly at the top and crosses at about one space from the line, and then joins the small letter following, when written in a word. Shade may be on either the first or last curve, but the heaviest part should be at the middle point. Exercises Nos. 12 and 13 should be practised with *O*.

Many of the capital letters known as the standard capital letters will be followed with an abbreviated or simpler style, which as a rule will, in our opinion, be better adapted to rapid writing than the one commonly used and designated as the "standard" letter.



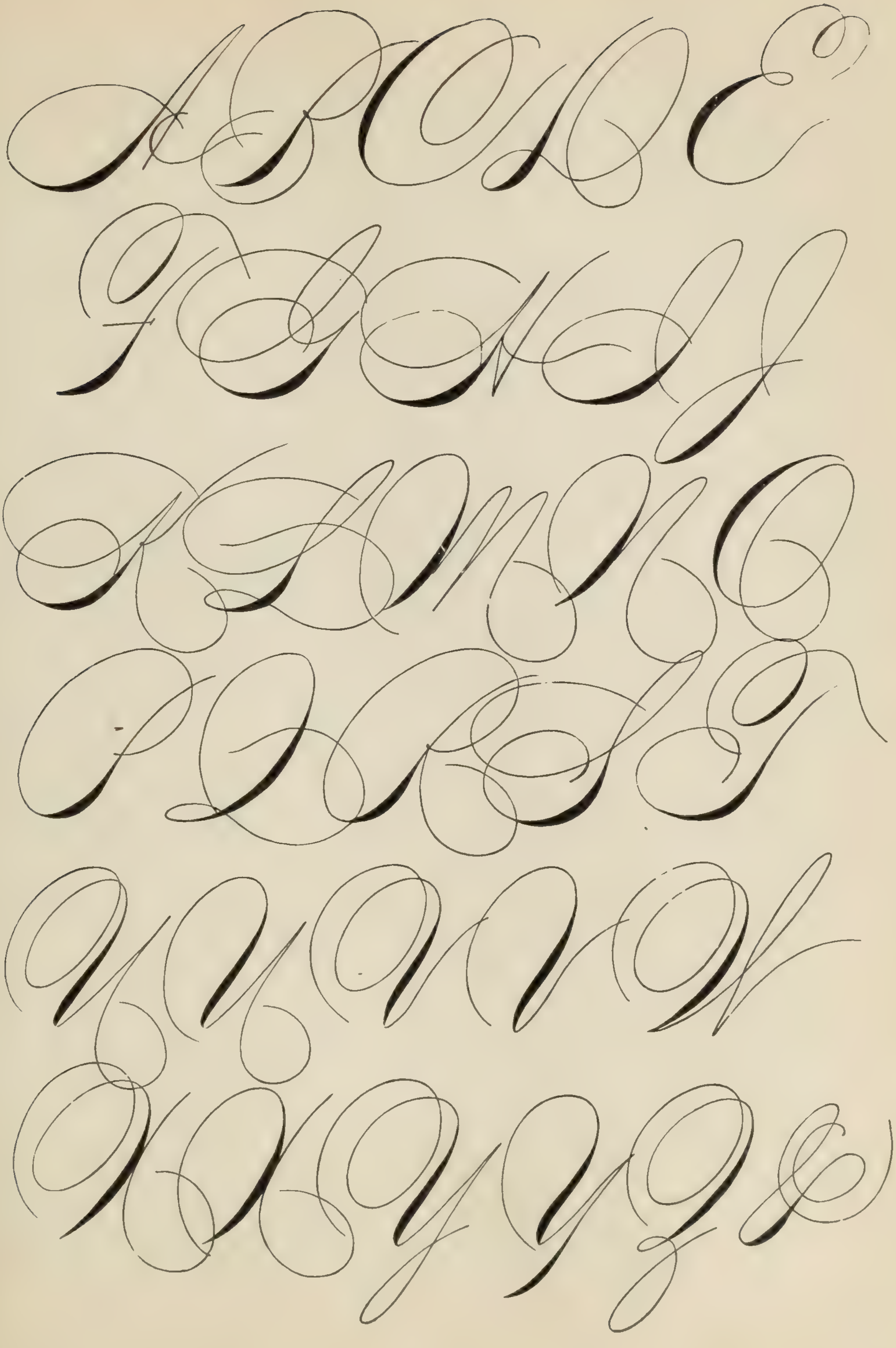


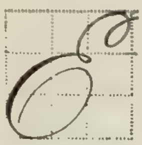
Capital *N* is formed from the seventh principle. Beginning like capital *O* and continuing half-way down, it joins an opposite curve, forming a reversed curve which extends to the line, and turning abruptly to the left and extending up three fourths of one space, it crosses the reversed curve, forming a loop; extending again to the line in a full, broad curve, it joins a curve which extends upward, finishing from this point like capital *O*. Height, three spaces; width, four spaces. The continuing shade should be on the lower half of the reversed curve, if made on the first part of the letter; if on the last curve, shade as in capital *O*.

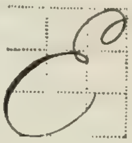
The business *N* is changed from the standard precisely as in capital *O*.

Exercises to be used are same as for the preceding letter, and No. 19 in addition. In all of these exercises, practise them with a steady, uniform motion, in about as rapid movement as that used to construct the letter.

Capital *E* is formed also from the seventh principle, to which is prefixed a modified seventh principle or fourth principle. Beginning at the full height, — three spaces, — extend



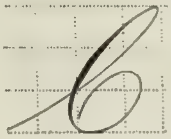


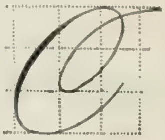


downward about three fourths of a space, with a slight curve bending to the left; turning to the right and extending up as in the fourth principle, it crosses the first curve near the top, when it again descends one space, and with a small loop joins the seventh principle made two spaces long, thus making the letter three spaces in height. A line drawn through the little loop at the centre the longer way of the loop would be nearly at right angles to a line drawn at the main slant of the letter. Height, three spaces; width, three spaces.

The exercises that need practice in connection with this letter are the same as those used for capital O, with the addition of No. 18.

The business E is made like the preceding letter as far as the line, where it joins a curve terminating like small e. This letter is easily joined to the small letters in words, its use saves some time, and it is also easier to write.

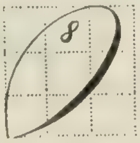




The capital C begins at the line with a curve, extending upward to the right through three spaces, where in a short turn it joins the seventh principle, which in finishing is contracted, the last part extending upward to one half the full height. The downward curve crosses the first curve at one space from the line. Height, three spaces; width, four spaces; the upper loop little more than half a space wide; shade as in O. Practise exercise No. 21 and follow it with No. 17. This capital letter may also begin above the line, as shown in the exercise last alluded to.

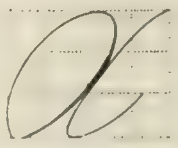
Capital C is also formed like the upper half of capital E enlarged to fill three spaces. The first curve extends downward two spaces. The distance between the first curve and the right portion of the letter is one space, and almost the same on the left of the first curve. Shade as in capital O. Height, three spaces; width, two and three fourths spaces. Exercise No. 22 reversed would be suitable for practice to precede this letter.

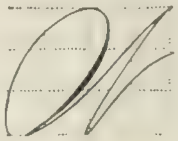
In all of these letters based on the seventh principle, care should be shown to avoid making any part of the letters angular.



Eighth Principle. We have next letters based on the eighth principle, which is nearly an inverted seventh principle. The general outline of this principle is that of an oval or ellipse, the greatest distance across at the middle point equalling about one half the slanting height of the letter, or one and three fourths spaces. The first curve, beginning at the line, extending well to the left and upward three spaces, is like the first curve of capital O. At the top it unites in a broad turn to an opposite curve which descends to the line, touching about half a space to the right from the starting-point. The downward line is made a little nearer straight as it approaches the line. Shade heaviest at the middle, gradually diminishing to the line.

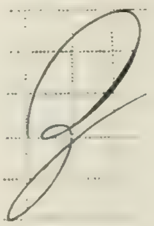
Capital H is formed from the eighth principle, to which is joined a part of the fourth principle enlarged. If you will compare this last part with the fourth principle, you will readily see how much of it is used. The two parts touch at the middle point; distance between them at the top, about one and one third spaces. Avoid beginning the last part too far to the right, thus making the letter resemble a badly formed K. Practise movement exercise No. 22. Height, three spaces; width, four spaces. This is as simple as the letter can be made, and is commonly used for business purposes.



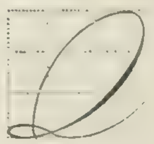


Capital W, like H, begins with the eighth principle; to this is joined in an angle at the line an upward line, curving slightly to the right and extending to the full height, where it again joins in an angle to a downward line quite straight. This continues to the line, where it joins in a angle not quite so sharp to an upward line curving slightly to the left, terminating at two spaces from the line. At the middle of the letter the three spaces should be equal. Height, three spaces; width, four spaces. Practise on exercise No. 15, followed with No. 22.

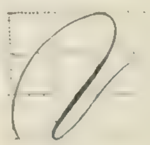
When no abbreviated forms are mentioned, it is to be understood that the one already given is considered the best for business uses.



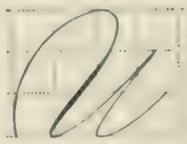
Capital Z combines the eighth principle and the sixth, united in a small loop at the line. The sixth principle is modified by curving the downward line somewhat more than usual, similar to that employed in the small z. The loop at the middle should not exceed one third of one space in height. Full length of the letter, five spaces; width, three spaces. Same movement exercise as for W.



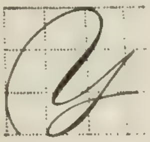
Capital Q is also formed from the eighth principle, modified by curving the lower part of the downward stroke more to the left, and extending it half a space to the left of the beginning point, where in a short turn upward it unites with a reversed curve, forming a loop by crossing the downward curve half a space to the right from the beginning point of the letter, touching the line and ascending one space high, terminating the letter. The height of the small loop is one fourth of a space, and the length is one space. The letter is three spaces high and three wide.



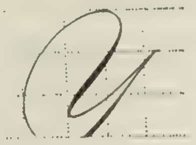
Capital V begins with the eighth principle, which is modified by making the downward stroke more nearly straight and turning to the right just before touching the line, and uniting with a slight reversed curve terminating at two spaces above the line. The distance between the downward stroke and the end of the last curve is one space; at the middle point little more than half a space. The shade should be of uniform thickness the greater part of the way, increasing and diminishing at the upper and lower parts alike. Height, three spaces; width, three spaces.



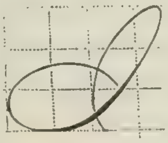
Capital U is formed from the eighth and first principles combined; the eighth as used in the V, and the first as used in the small i, except being made two spaces in height. Both downward strokes are straight, slant alike, and should be one space apart. The turns at the bottom should be alike. Height, three spaces; width, four spaces. Avoid making the downward strokes too nearly vertical, or turnings too broad. Never shade last part of the letter.



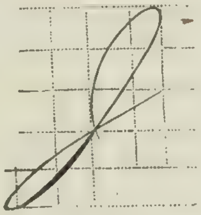
Capital Y combines the eighth and sixth principles in its formation. All above the line is precisely like capital U. The sixth principle is modified by extending upward two spaces above the line, instead of one as in small j. Full length, three spaces; width, three and one half spaces. Be careful not to make the lower loop too wide or too long.



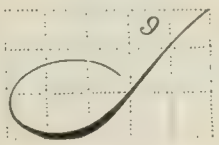
We have also another style of Y, which is used largely and will be found to cause a better looking page if employed in all cases where one Y is to be written directly beneath another, as in lists of names, especially if the paper is closely ruled. You will observe the eighth principle is shortened in the downward stroke, and the last stroke is similar to that used in making figure 1.



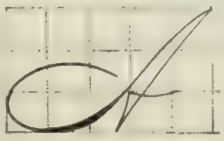
Capital I begins with the eighth principle, as in W, but is made only one space wide across the middle part, and crosses the first stroke about one third of one space above the line, when it terminates with the ninth principle as in capital A. The last curve crosses the first curve at half the height of the letter. Height, three spaces; width, three and one half spaces.



Capital J begins like capital I, with the downward stroke just touching the end of the first curve at the line and finishing with the sixth principle. The shade on the letter is all below the line. The upper loop is nearly twice as wide as the lower. Full length, five spaces; width, four spaces.

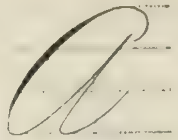


Ninth Principle, or capital stem, is three spaces high. Beginning at full height, descend with a reversed curve to the line, the lower half of which is shaded; here it unites in a broad turn with an outward curve, which extends upward to half the height and continues over and down terminating at one and one fourth spaces above the line. Full height, three spaces; width, five spaces. Before beginning any of the letters based on this principle, practise thoroughly on exercise No. 14.

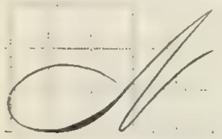


Capital A begins with the ninth principle, to which is joined at the top, in an angle, a line nearly straight, which descends to the line at the regular slant, where it joins in another angle to a slight upward curve which touches the first part at one space from the line; again joining in an angle with a slight curve downward and extending to the right one space from the straight line, and terminating one space above the line. Height, three; width, five spaces. Exercise No. 14 is best for help in the execution of this letter.

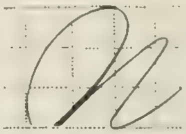
Business A is nearly like the small a enlarged. Begining at two and one half



spaces above the line, extend it upwards half a space, curving to the right; at the top it unites in a full turn with a downward left stroke curving like small *a*; when it touches the line turn full to the right, and complete the letter with the first principle extended upward two and one half spaces. One advantage of this letter over the other is in its being more easily written and connected with the small letters without raising the pen.

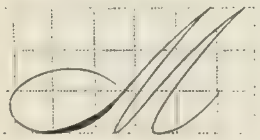


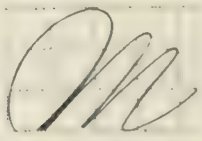
Capital *N* begins like the *A* with the ninth principle, joined at the top with a downward stroke as in *A*, which finishes with a curve as in *W*, except it is not quite so angular at the joining on the line. Two equal spaces should be made at the middle between the three lines. Height, three; width, five spaces. Drill on same movements as for *A*.



Business capital *N* begins with the eighth principle, to which is joined an enlarged third principle, made two and one third spaces high. This principle joins by retracing the straight line one space. The shade on the eighth principle in this letter differs from that of *W* by beginning at the middle of the downward line and gradually increasing to the line, when the pen should be raised quickly to secure a square shade. Height, three; width, three and one half spaces. Exercises Nos. 15 and 22 should be practised for this style of *N*.

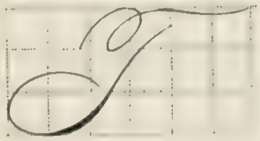
Capital *M* begins like capital *N*. There is no difference in the first and second parts; the third line extends upward to the full height, where it joins in an angle to a line like the finish of capital *X*, or to the left half of the fourth principle. The distance between the two points or angles at the top of the letter should not exceed one space. Height three spaces; width, six.





Business *M* is a combination of the eighth, second, and third principles. First part is three; second, two and one third; and the last two spaces high: width of letter, four spaces. The first and second parts unite at one space from the line by the second part retracing as in *N*, while the second and third parts join in an angle at the bottom as in the middle part of small *m*.

Capital *T* is made usually in two parts, the ninth principle being first formed, and made to differ from *A* by curving more and beginning only two and one half spaces high. The upper part begins one and one third spaces to the left from the main part, and at two spaces from the line; a loop is here formed which is one space long and half a space wide; the same distance also should be made between the loop and the top of the



Philadelphia Nov 2. 1882

L. P. Hamilton Esq.
Detroit, Mich.

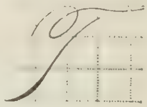
Sir:- Your favor of the 29. ult. has received our attention, and we are glad to say that we have been able to execute your order in such a manner as we think will please you.

In order that there should be as little delay as possible we have forwarded the goods per quickest freight.

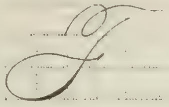
Holding ourselves in readiness for your further commands and assuring you of our best wishes,

We are, very truly
Randall Bro's.

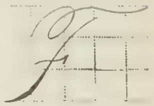
ninth principle, and on the left of the loop. The last curve of the loop is a full reversed curve, the highest point of which should be directly over the beginning point of the first part or ninth principle. Height, three spaces; width, six spaces.



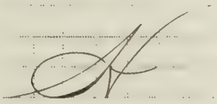
The abbreviated T differs from the one just illustrated only in the lower part of the ninth principle, which terminates at the line.



Capital F is formed on the same principles as T, the only difference being in the last curve of the ninth principle crossing the downward line at the middle of the letter, and curving slightly upward, where it joins angularly to a short curve made parallel to the main downward line, and distant from it one fourth of a space.

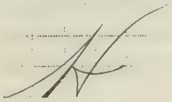


The abbreviated F differs from the T in the same respect only as that just mentioned.

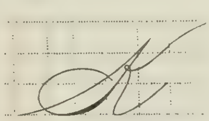


Capital H is formed from the ninth principle, two and one half spaces high, and to which is prefixed a slight curve as in the beginning of small i, which joins the principle angularly. The last part begins about two spaces to the right from the top, with a full curve bending to the left down half-way, when it merges into a straight line finishing precisely as in capital A. Height, three spaces; width, six spaces.

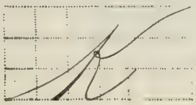
The faults likely to occur in this letter will be in making too great a distance between the parts, and in making them at different degrees of slant.



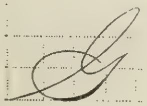
The abbreviated capital H is much to be preferred in rapid writing. The abbreviation consists in omitting the finishing part of the ninth principle, as in capitals T and F.



Capital K is made to begin like the preceding letter; no difference whatever in the first half. The last part begins at the same point as in H, but the downward line is a reversed curve and touches the first part at the middle, where it joins in a small loop which is made around the downward stroke of the first part, with a part like the last half of the third principle, except that it is made more nearly vertical. Height, three spaces; width, six spaces. Avoid making the little loop too low or too large, and be careful to make the loop at or nearly at right angles to the main slant of the letter.

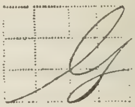


The abbreviated K, as will readily be seen, corresponds in its abridgment exactly to the H.

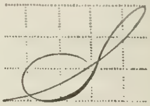


Capital G begins with a loop exactly like one form of capital C, the downward stroke crossing at the same point, but curving upward, immediately after crossing, to half the height of the letter, where it joins in an angle to the ninth principle, which finishes as in capital *H*. The first upward curve divides the finishing oval equally. Height, three spaces; width, four spaces. In the construction of this letter, avoid making the first upward curve with too much slant.

In the abbreviated *G* the second part is usually made two spaces high; otherwise the abbreviation corresponds to that of *H* and *K*.

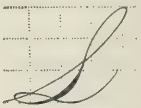


Capital *S* is formed from the ninth principle. Beginning at the line with a slight upward curve bending to the right, and extending to the full height, it joins at the top to the ninth principle, which curves much more in this than in any other letter. This principle, in its downward course, crosses the first stroke at one and one third spaces from the line, thus forming an upper loop not unlike the loop in small *l*. Height, three spaces; width, four and one half spaces.

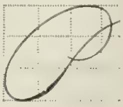


This letter is sometimes abbreviated by terminating the ninth principle at or just above the line, in a dot. The objection to this, however, is that persons attempting it are liable in their haste to join it to the small letters, thus often making it so nearly resemble *L* that it has often been mistaken for it.

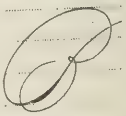
Capital *L* is precisely like the *S* as far as the line in the first and second curves; after touching the line, the letter is completed with a loop in a horizontal position, same as *Q*. Height, three; width, four spaces. Practise, as an exercise in movement for this letter, No. 16.



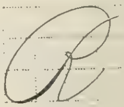
Capital *P* is made like *F* in the first part of the letter. The ninth principle after touching the line is extended upward, like the first half of the eighth, to the full height of the letter, and turning broad at the top, a full, round curve bending outward extends downward, crossing the first stroke at half a space from the top, and crossing again at the middle of the letter. The height is three; width, three and one half spaces. Practise exercise No. 20 or P, B, and R.

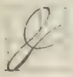


Capital *B*, as far as the loop, is formed as in the letter just preceding it. The loop is like *K*. After the loop is made, descend to the line with a full curve, bending outward as in the upper part, where it turns short and extends upward in an opposite curve, half a space in height. Height, three; width, three and one half spaces.

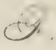


Capital *R* also begins like *P*, and differs from it in no respect as far as the loop, from which point the final part of the letter is exactly like *K*. Height, three; width, three and one half spaces.





This character is often used, and therefore a suggestion as to the method of constructing it may be introduced here.

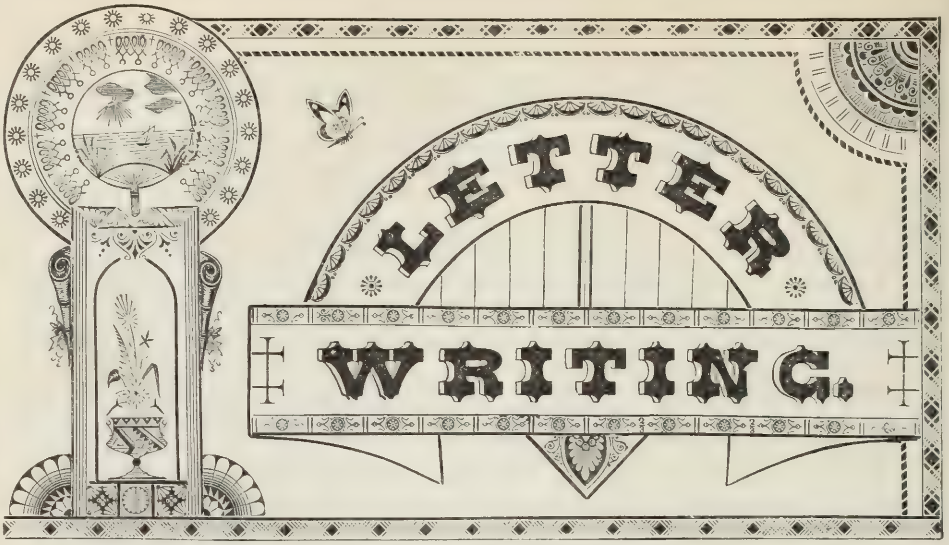
Beginning at one space from the line, with the ninth principle, as in the abbreviated , it joins at the line, in a short turn to the left, with a reversed curve, the opposite of the downward stroke; this extends to the height of two spaces; turning full to the left, complete the character by a downward curve similar to the lower half of the seventh principle, crossing the first stroke at three fourths of a space from the line, extending one space to the right, and terminating at the height of one space from the line. With this character we complete the analysis of all the letters of the alphabet, both large and small, as well as the figures.

While a theoretical knowledge of the proportions of letters is first of all essential, it is but a single step toward a good handwriting; without a great deal of careful practice, no one can ever expect to become expert as a penman.

This analysis and explanation have been given that the practice may be intelligent; for to practise without a definite form in the mind would result in as complete failure as the attempt of a marksman to secure his game by firing without first taking aim.

If possible, set apart a certain portion of every day for practice, and let no trifling matter interfere with the prosecution of your purpose. Unless this is done, interest will soon cease, and practice will be given up altogether.

Probably no one accomplishment, within the reach of almost every one, will furnish a better stepping-stone to a successful business life than that of penmanship. Hundreds of young men, and young women too, are realizing the truthfulness of this assertion every day, — many of whom are occupying responsible and lucrative positions secured largely if not solely on account of their ability to write well. An earnest determination, persistently followed, will make success a certainty.



LETTER WRITING.

MAN, in all ages, wherever situated, has sought the devices, and found the means, needful for the communication of his thoughts to people at a distance.

All history is but the record of such communications and their results.

The rude, untutored savage, in his own primitive way, indicates by some sign or token his desires or intentions to those far away; sending, for instance, an arrow when declaring war, or a ring when praying for peace.

The messenger may be obliged to spend weeks and even months upon the road, forcing his way through pathless forests and shadowy jungles, over mountains and along lowering cliffs, before reaching the end of his journey; yet through this—his peculiar—letter the sender will speak, as it were, to the recipient.

On the other hand, we, with our almost incredible facilities for postal service, send our thoughts this way and that over hundreds of miles in a single day. Thus mind is linked to mind, and friends far away seem near.

Without this means of intercourse, persons long separated from near and dear ones would become melancholy, morose, and disagreeable to those with whom they come in contact.

The heart, untouched by any word of remembrance or affection, would soon grow hard and cold; and the isolated individual would look upon his kind only as antagonists in the struggle for existence.

There is no more desirable accomplishment than that which is requisite for good letter writing. To some it seems a natural gift, while others acquire it only by patience and perseverance; yet, with proper effort, no one should fail.

PENMANSHIP.

The first requisite of a well-written epistle is an easy, graceful formation of the letters. To secure this, avoid all hurry and write plainly and clearly, paying great attention to neatness; as a clean sheet, with plain, clear-cut letters, will be rated higher than a letter executed in a slovenly manner; and to cover the page with gems of thought, the reading of which the penmanship will not permit, is worse than useless.

We should endeavor to write plainly and distinctly; for in a busy age like the present, when every one's time has a certain value, we have no right to impose the reading of hieroglyphics upon our correspondents.

Care should be taken that all *i*'s are doted and all *t*'s crossed, as well as that the letters are well-shaped. If, however, you make a badly formed letter, let it alone: any attempt at patching will not improve it, while the endeavor will be readily seen.

GRAMMAR AND SPELLING.

The next important consideration is, to be sure that the words are correctly spelled and grammatically arranged.

Although it may seem strange, it is much more common to find the short words of every-day use misspelled than the longer ones which are only occasionally employed. The probable cause of this is, that an unusual combination of letters forces the writer to pause and consider the word.

Many, however, spell badly from ignorance; and, when this is the case, the study of the spelling-book should be no longer neglected, as incorrect spelling may expose the most important and interesting letter to criticism or ridicule.

Carelessness will not be considered, and ignorance of orthography is a most lamentable lack in a person's education.

Bad grammar is equally to be condemned. For a man to be ignorant of the English language is inexcusable, and penmanship so bad, even, as to be almost illegible, is preferable.

PUNCTUATION.

Improper punctuation often renders the meaning of a sentence unintelligible, or the opposite of what is intended.

In order that a writer may be readily understood, it is necessary to divide the words into paragraphs, sentences, and clauses.

The effect of omitting proper marks of punctuation may be seen in the following example, in which it is difficult to tell whether the person described is a very good or a very bad man:—

> "He is an old and experienced man in vice and wickedness he is never found in opposing the works of iniquity he takes delight in the downfall of his neighbors he never rejoices in the prosperity of any of his fellow-creatures he is always ready to assist in destroying the peace of society he takes no pleasure in serving the Lord he is uncommonly diligent in sowing discord among his friends and acquaintances he takes no pride in laboring to promote the cause of Christianity he has not been negligent in endeavoring to stigmatize all public teachers he makes no effort to subdue his evil passions he strives hard to build up Satan's kingdom he lends no aid to the support of the gospel among the heathen he contributes largely to the evil adversary he pays no attention to good advice he pays great heed to the Devil he will never go to heaven he must go where he will receive his just reward."

The rules for PUNCTUATION, GRAMMAR, and the USE OF CAPITALS may be found under "Orthography."

STYLE OF LETTERS.

Write as you would talk.

Your letters, especially in friendly correspondence, should bear the impress of your personality.

Endeavor to avoid all appearance of constraint. The style should always suit the subject and the person addressed.

To a minister or judge, the light, airy treatment of a subject might be almost offensive; while in general society, a heavy or grave style of treatment of the same subject would perhaps excite derision.

TECHNICAL TERMS.

In writing on business or to artisans, use technical words and phrases when certain of their meaning; but to employ such expressions in ordinary letters, particularly to ladies, is impolite.

For the same reason, a parade should not be made of those expressions in use in one's trade or profession.

FOREIGN QUOTATIONS.

Latin, Greek, and other quotations are also inappropriate to use in letters, unless the persons written to understand them.

Through the use of foreign quotations by those who are not acquainted with the languages, and are endeavoring to shine in borrowed plumes, mistakes are often made which appear ridiculous to educated persons. Thus, a young lady, having heard somewhere the Latin phrase *tempus fugit*, — i. e., *time flies*, — soon after electrified the house with " *Tempus is fugiting;* let us go home."

French, as the language of love, fashion, diplomacy, and polite society, may sometimes be allowed, as far as phrases go.

But to quote whole verses of poetry or paragraphs of prose from any foreign tongue is in bad taste, since there is no foreign expression which has not an equivalent in English.

Avoid the use of slang words and phrases; they disfigure correspondence and show questionable taste.

FIGURES.

The Arabic characters, 1, 2, 3, etc., should not be used, except where they may prevent mistakes, or to express dates or sums of money.

For greater certainty, especially in business letters, bank-checks, etc., amounts of money written in words are generally repeated in figures; thus, two hundred ($200) dollars.

PARTS OF A LETTER.

A LETTER may be divided into six parts, namely, the Writer's Address in full, Date, Complimentary Address, Body, Complimentary Close, Signature.

These parts may occupy a position something as follows: —

Writer's Address, — Date.

Name.

Address.

Complimentary Address.

Commencement.

....

....

Complimentary Close.

Signature.

Or the writer's address may be placed at the bottom of the letter.

[When the body of the letter is to be very short, then the address may be put on a line low enough, so that the letter will appear on the centre of the page; otherwise the letter might not reach the middle, leaving the lower half of the page blank, which would not look well.]

POSTAL CARDS.

POSTAL CARDS are much used for short business messages, and also among friends where no formality is desired.

A double postal card is furnished by the government, by which a message can be sent and answer returned on the same card.

Never write anything on the face of the card except the address.

DATE.

Always DATE every letter, as this will prevent confusion.

The date should be written on the right-hand side of the first line of the page, thus: —

AUG. 1, 1882.

DEAD LETTERS.

As there are a great many letters sent to the Dead-Letter Office or lost, the proper way is to have your own address, and the address of the party for whom the letter is intended, in the letter, as then the letter will eventually be delivered to one of the parties, even if there has been a neglect to direct properly or use sufficient postage.

ADDRESSES.

It is quite common to see letters addressed similar to the following: —

J. GOODENOUGH, ESQ.
Dear Sir, —

MESSRS. SMITH & BOWLES.
Gentlemen, —

But this is hardly correct, as both titles in each case, Esq. and Sir, and Messrs. and Gentlemen, mean the same, which can be avoided by giving address in full in commencing, as follows: —

J. GOODENOUGH, ESQ.,
CANTON, CHINA:
Dear Sir,

The title, "Dear Sir," following on the next line after the address, as above.

This is perhaps the better way, as it adds to the appearance, and is the style in which business letters are generally commenced. Or you can commence with date and formal title of respect, thus: —

JULY 25, 1882.
Sir,

and add name and address on the left of the page, after the close of your letter.

By having your address with the date thus —

HARPER'S FERRY, VA., May 7, 1882.

and your signature at the close, your full address is in the letter. Or you can commence with the date simply, and, in closing your letter after your signature, you can add your address, which is generally essential, as the person for whom the letter is intended might not otherwise know where to direct in reply. The forms have been given here; and to save space, in this work the address will not be on some of the following letters.

FORMS COMMONLY USED FOR THE MONTHS.

Jan., January; Feb., February; March, March; April, April; May, May; June, June; July, July; Aug., August; Sept., September; Oct., October; Nov., November; Dec., December.

COMPLIMENTARY ADDRESS.

The complimentary address is the term of respect or affection with which we commence a letter, and of course varies with circumstances.

In letters of business the terms commonly employed in addressing a man are,—"Sir," "Dear Sir," "My dear Sir," "Respected" or "Honored Sir," etc.

In writing to a firm, "Messrs.," "Sirs," or "Gentlemen."

In addressing a married woman, use "Madam," or "Dear Madam."

In addressing a single woman, "Miss," "Dear Miss," etc., or "Mlle.," a contraction of mademoiselle. In France, and Europe generally, the term "Madame" is also a title of distinction, as women of rank, acquired or inherited, even if unmarried, are entitled to the distinction of being, and are, addressed as "Madame." From this probably follows the custom here that, when you are in doubt as to a lady's being married or single, you may use the term "Madam."

In addressing more than one lady, use the title "Ladies."

In writing to a single lady, the complimentary address is often omitted, to avoid the repetition of "Miss."

TITLES.

It is also customary, in the complimentary address and superscription of a letter, to give the person addressed his proper title. These are divided into two classes,—titles of respect and professional titles.

The titles of respect are,—"Esq.," from Esquire, the title of an English justice of the peace, but here applied indiscriminately; "Mr.," mister, from master; "Mrs.," mistress, pronounced *missis* when abbreviated and applied to a married woman; "Madam" is from the French, and applied to a married woman, or to a lady when in doubt as to her being married or single; "Miss," from the French demoiselle, applied to unmarried women; "Mlle.," mademoiselle, from the French, applied to a young woman (not in common use).

The principal titles of distinction in England are the following:—

TO ROYALTY.

"To the King's Most Excellent Majesty"; "To the Queen's Most Excellent Majesty"; "To His Royal Highness Albert Edward, Prince of Wales."

In like manner all the other members, male and female, of the royal family, are addressed.

TO NOBILITY.

"To his Grace the Duke of Montrose"; "To the Most Noble the Marquis of Westminster"; "To the Right Honorable the Earl of Essex"; "To the Right Honorable the Lord Viscount Sterling"; "To the Honorable Baron Renfrew."

The wives of noblemen have the same titles as their husbands, thus:—

"To her Grace the Duchess of Montrose"; "To the Most Noble the Marchioness of Westminster"; "To the Right Honorable the Countess of Blessington"; "To the Right Honorable the Viscountess Sterling"; "To the Honorable the Baroness Renfrew."

In Great Britain, the title "Honorable" is given to the younger sons of noblemen (the elder son taking the title next in rank to that of his father). It is likewise applied to members of Parliament, and persons holding positions of honor and trust.

TO BARONETS.

"To Sir Robert Peel, Bart."

TO KNIGHTS.

"To Sir Charles Gavan Duffy, Kt."

TITLES IN USE IN THE UNITED STATES.

"The President of the United States"; "His Excellency," Governor of any State, and Ministers to foreign countries. "Honorable" is applied to the Vice-President of the United States, members of the Cabinet and members of Congress, heads of departments, judges, consuls, mayors of cities, etc.

D. D., doctor of divinity; LL. D., doctor of laws; Rev., minister of the gospel; Dr., physician and surgeon; Prof., professor or teacher; Esq., member of the legal profession, etc., indiscriminately used; and other professional titles too numerous to mention.

TITLES OF THE DIGNITARIES AND OTHER OFFICERS OF THE CATHOLIC CHURCH.

The Pope, "His Holiness Pope Leo XIII."; a cardinal, "His Eminence Nicholas Cardinal Wiseman"; an archbishop, "Most Rev. James Gibbons, D. D."; a bishop, "Rt. Rev. M. Flannery, D. D."; a vicar-general, "Very Rev. Edward McColgan"; a parish priest, "Rev. James Keogh, P. P."; a lady superintendent of a convent, "Sister Superior."

MILITARY TITLES IN THE UNITED STATES.

Commissioned Officers.

General of the Army,
Lieutenant-General of the Army,
Major-General,
Adjutant-General,
Inspector-General,
Quartermaster-General,
Commissary-General,
Paymaster-General,
Surgeon-General,
Brigadier-General,
Brigade Inspector,
Colonel,
Lieutenant-Colonel,
Major,
Captain,
Chaplain,
Adjutant,
First Lieutenant,
Second Lieutenant.

TITLES OF NAVAL OFFICERS.

Rear-Admiral,
Vice-Admiral,
Commodore,
Captain,
Commander,
Lieutenant-Commander,
First Lieutenant,
Second Lieutenant,
Master,
Ensign,
Midshipman,
Paymaster,
Assistant Paymaster,
Chaplain,
Chief Engineer,
Purser, or Storekeeper.
Mate — First, Second, and Third,
Quartermaster,
Master-at-Arms.

Two titles of the same class should not be applied to the same person, as *Hon.* Wm. Wilson, *Esq.*

FOLDING.

The folding of a letter is a simple matter when, as now, the envelope is adapted to the width of the sheet. Take the letter as it lies before you, having the first page uppermost, turn up the bottom about one third the length, and bring the top down over this, being careful to have the sides even. In placing in the envelope, put in first the edge last folded.

The SUPERSCRIPTION is the address of the person written to, to be placed on the outside of the envelope.

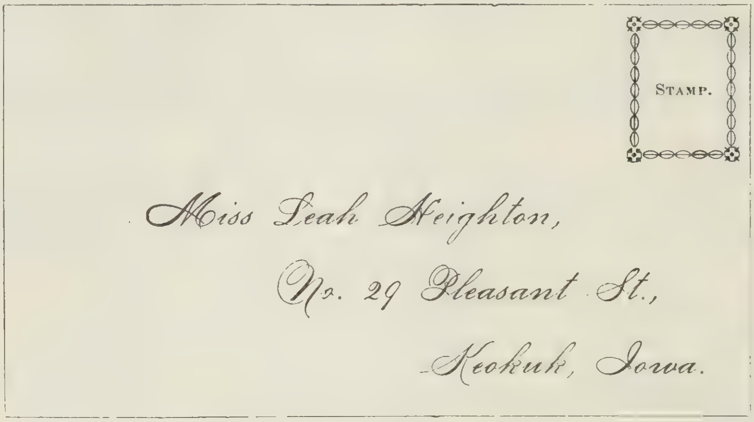
Politeness requires that some title be used with the name, and this will also often aid in identifying the party for whom the letter is intended.

The superscription should begin just below the middle of the envelope, near the left edge, and may occupy three or four lines, each one of which should end with a comma, except the last, which should end with a period.

These lines should slant toward the right, the distance between them being the same, and the last line ending near the lower right-hand corner.

The name and title should be upon the first line.

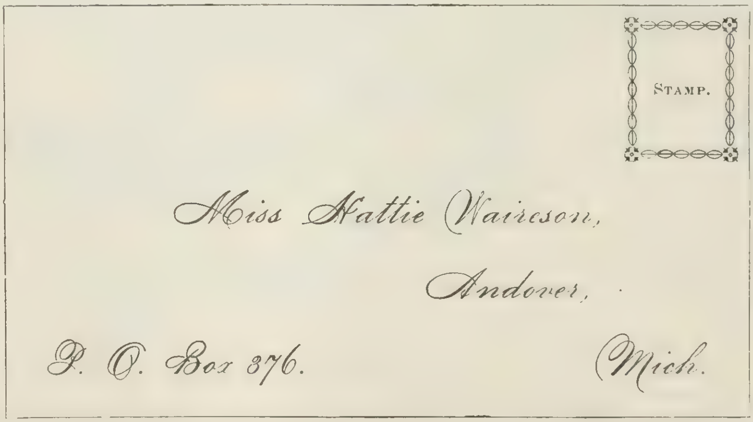
If the person addressed be in a city, the street and number should be upon the second line, the city and State on the third; thus:—



STAMP.

Miss Leah Heighton,
No. 29 Pleasant St.,
Keokuk, Iowa.

The number of the post-office box may be used instead of the street and door number. It is placed in the lower left-hand corner; thus:—



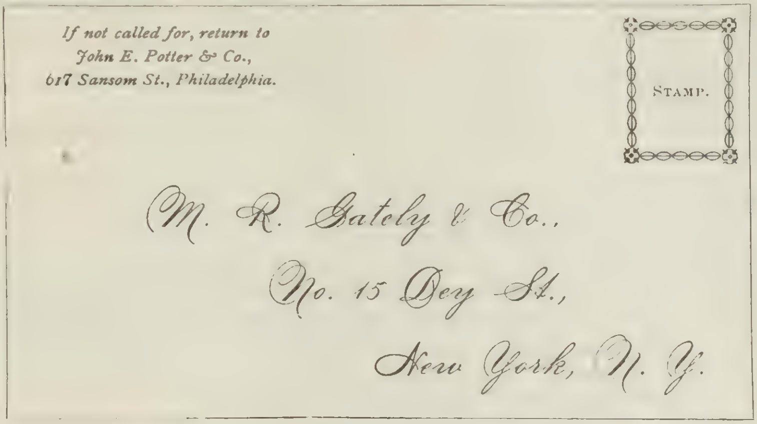
STAMP.

Miss Hattie Waireson,
Andover,
P. O. Box 376.
Mich.

When a letter is sent to one person in care of another, the words "Care of," etc., are placed upon the second line.

When a letter is delivered by a friend, the name of the person, with the words "Kindness of" or "Politeness of," is placed in the lower left-hand corner.

The address of the writer is often printed in the upper left-hand corner of the envelope, with the request that, if not delivered within a certain time, it be returned; thus:—



If not called for, return to
John E. Potter & Co.,
617 Sansom St., Philadelphia.

STAMP.

M. R. Gately & Co.,
No. 15 Dey St.,
New York, N. Y.

LETTERS OF INTRODUCTION.

Letters of introduction should be sparingly given, and never unless you are thoroughly acquainted with the applicant and approve of his claims for such favors.

Remember that when you give letters of introduction you place both yourself and your friends under great obligations to those to whom they are addressed.

If they live in a large city, like Philadelphia or New York, you in a measure may compel them to undergo the trouble of escorting the stranger to points of interest and places of public amusement.

Always ask yourself whether the person introduced will be an acceptable acquaintance to the one to whom you present him, and whether the latter is such a one as you are willing should claim to be your friend, and for whose conduct, in the society to which you introduce him, you are willing to be held responsible.

Letters of introduction should be brief and carefully worded, as they are generally read in the presence of the person presenting them, and at best make an awkward pause during their perusal.

The envelope must be left unsealed, though it may be sealed before delivery by the one introduced.

You can speak in the warmest and most cordial terms of your friend; still praises are almost as much out of place as they would be at a personal introduction, and modest persons sometimes shrink from delivering letters which appear to them undeservedly complimentary.

If your own knowledge of the person is slight, you may mention by whom he was presented to you.

If he be an artist, you are at liberty to speak of the pleasure his skill may have given you.

The name of the party presented should be written *in the lower left-hand corner.*

PRESENTATION.—The better way to present a letter of introduction to a private family is in person: but there are some objections to this, one of which is that you thus in a measure compel them to receive you, and hence many prefer to send it by a servant, together with a card; thus giving the receiver an opportunity to call upon you, or invite you to his home.

When a gentleman delivers such a letter to a lady, he is at liberty to call upon her; sending her his card to ascertain whether she will receive him then, or appoint some hour which will be more convenient.

The same is true of those whose stay in the city is to be short.

Letters of introduction are necessary in the country, especially where new-comers enter a new abode and desire to become readily acquainted with their neighbors.

The residents should call first upon a new-comer, unless he brings letters of introduction, when he is the first to call.

If a stranger sends you a letter of introduction and his or her card, you are bound to call the next day *or* send an invitation to call upon you, and also, if he be from out of town, to escort him to places of public interest.

When you invite a stranger to call upon you, it is better to ask other friends, thereby affording an opportunity of making other acquaintances, and assisting your friend to promote the object for which he gave the introduction to you; but care should be taken to ask only the stranger's social equals, and such as he will be pleased to meet.

In travelling, one cannot have too many letters of introduction, as without these he may often be without means of making friends.

The following are examples of letters of introduction: —

Introducing Mr. Reynolds to Mr. Belden.

HUDSON, N. Y., Nov. 2, 1882.

MR. H. R. BELDEN,
Boston, Mass.:

My dear Sir, — This will introduce to your acquaintance my friend, Mr. Reynolds, for whom I have great esteem, and whom I am sure you will be happy to know.

Any attention you may have it in your power to bestow during his visit to Boston will be gratefully reciprocated by

Your friend,
H. S. WHITE.

Introducing an Artist to a Lady Friend.

BELLEFONTAINE, PA., June 1, 1882.

MY DEAR MRS. GRANGER:

My young friend, Mr. E V. Hardon, being about to visit your city, it gives me great pleasure to introduce him to you, knowing your great love and keen appreciation of the art to which he has devoted his time.

He is desirous of visiting the principal art galleries of your city, and I know of no one who will offer him more valuable and kind assistance in this respect than yourself.

With kindest regards to you and your family,

I am, my dear madam,
Very respectfully yours,
T. F. MORRISON.

Introducing a Young Lady.

NEWFANE, WIS., Dec. 9, 1882.

MR. T. H. GRIFFIN,
Springfield, Ohio:

Dear Sir, — I take much pleasure in introducing to you my esteemed friend, Miss Clara Harland, a young lady who will spend a few months in your city. I am sure an acquaintance with her will be a pleasure to you.

Any favor you may show her during her stay in your city I shall consider a personal one.

Yours sincerely,
MRS. J. H. HOWARD.

Introducing a Gentleman to a Lady Friend.

HARTFORD, CONN., May 6, 1882.

MY DEAR MISS JOHNSON:

My friend, Mr. T. E. Carter, purposing to make his home in your city, I venture upon the kind hospitality you have always extended to me to introduce him to yourself and family. Trusting that the acquaintance will be as pleasant as mine has been with both yourself and him,

I am, very respectfully,
Your friend and well-wisher,
J. F. GLENNON.

MISS MAUD JOHNSON.

Letters of introduction are sometimes written in the *third person*, as the following: —

Introducing Mr. Harry LeClair to Mr. Andrew Conroy.

CINCINNATI, OHIO, May 2, 1882.

Mr. Hanmer presents his compliments to Mr. Andrew Conroy, and begs to introduce to Mr Conroy the bearer, Mr. Harry LeClair, who is one of his most esteemed friends.

NOTES OF INVITATION.

Notes of invitation for large gatherings should be sent a week at least in advance, and should be written in the third person.

Among friends of long standing, however, a familiar note is employed.

Notes of invitation for evening parties should be issued in the name of the lady of the house.

The old-fashioned preliminary of "presenting compliments" before an invitation has passed out of use.

Do not "avail" yourself of an invitation, and do not speak or write of an invitation as an "invite."

If the party is small, written invitations may be used; but if large, printed forms should be employed, in which the name of the person to which each is sent is inserted.

The following are examples of invitations to dinner-parties, evening parties, weddings, etc.: —

Presidential Reception.

The President of the United States requests the company of Mr. George Gay at the reception to be tendered to His Royal Highness Albert Edward, Prince of Wales, on Wednesday evening, Dec. 4, at ten o'clock, at the Executive Mansion.

Invitation to a Dinner.

Mr. John Sinclair requests the pleasure of Mr. James Martin's company at dinner, on Thursday evening, May 2, at eight o'clock.

HAMPSHIRE HOUSE, March 25.

Acceptance of Foregoing.

Mr. James Martin has much pleasure in accepting Mr. John Sinclair's kind invitation for Thursday evening, May 2.

PALMER HOUSE, Tuesday, March 31.

Regret in Answer to Foregoing.

Mr. James Martin regrets that, owing to a previous engagement, he is unable to accept Mr. John Sinclair's kind invitation for Thursday evening, May 2.

PALMER HOUSE, May 1.

Invitation to an Evening Party.

Mrs. Curtis requests the pleasure of Mr. and Mrs. Hezilton's company on the evening of December 19, at ten o'clock.

No. 221 Orchard Street.

Acceptance of Foregoing.

Mr. and Mrs Hezilton accept the kind invitation of Mrs. Curtis for December 19.

No. 19 Bridge Street.

Regret in Answer to Foregoing.

Mr. and Mrs. Hezilton regret that, owing to the illness of their child, they are compelled to decline Mrs. Curtis's kind invitation for December 19.

No. 19 Bridge Street.

Invitation to Ride.

Mr. Phelps would be much pleased if Miss Gerry would accompany him in a drive to Mt. Holyoke this afternoon.

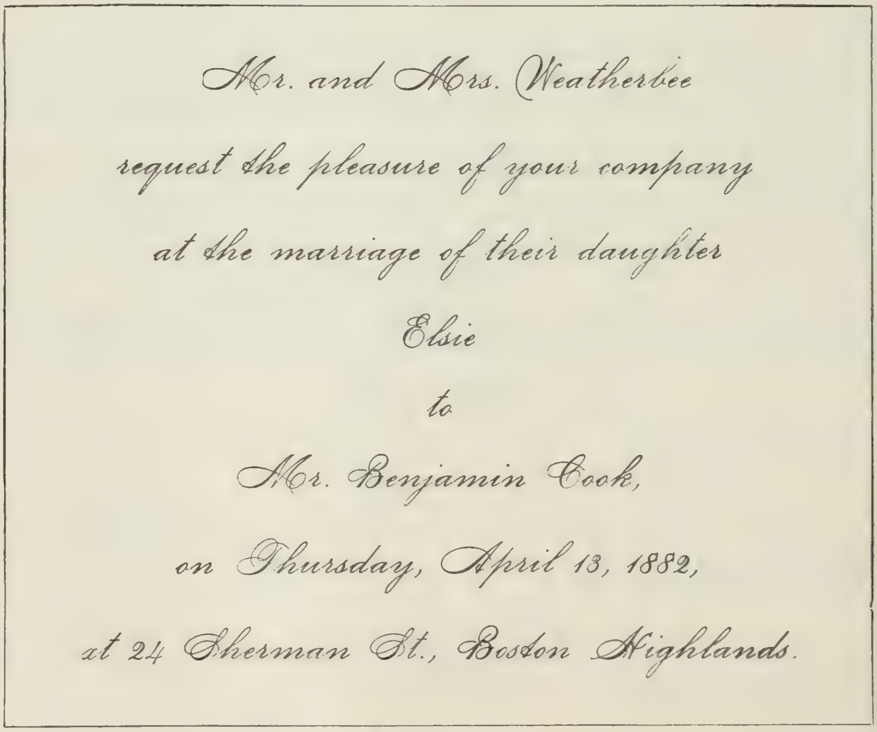
May 18, 1882.

Answer Accepting the Invitation.

Miss Gerry accepts with pleasure Mr. Phelps's kind invitation for this afternoon.

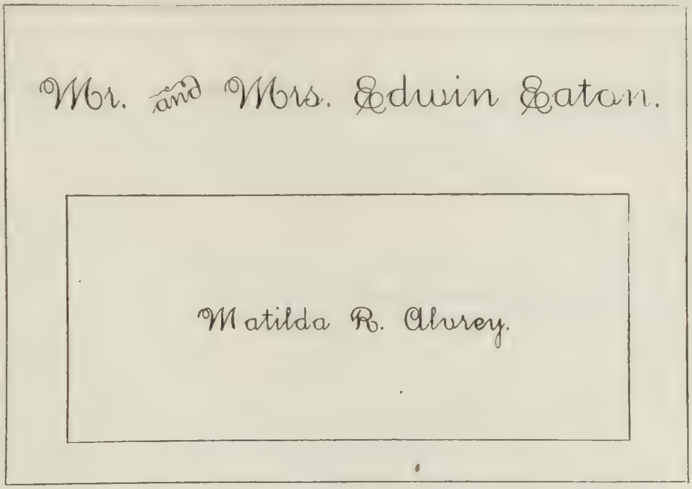
May 18, 1882.

Invitation to a Wedding.

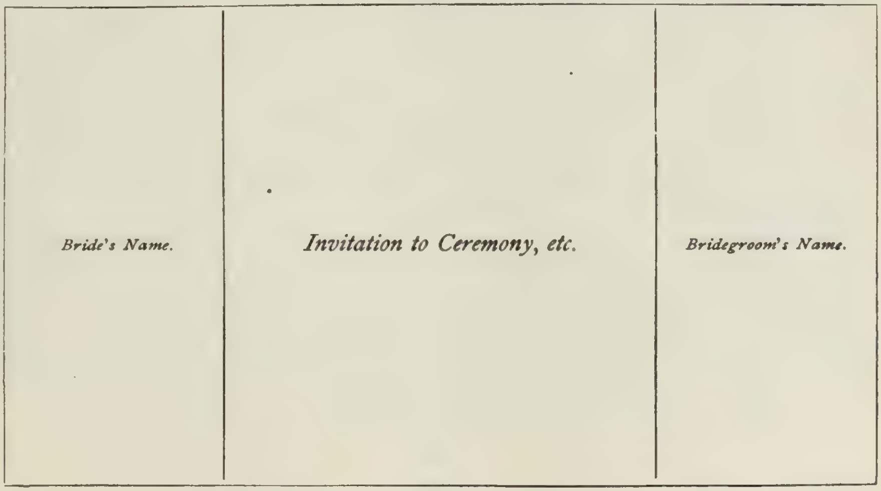


Mr. and Mrs. Weatherbee
request the pleasure of your company
at the marriage of their daughter
Elsie
to
Mr. Benjamin Cook,
on Thursday, April 13, 1882,
at 24 Sherman St., Boston Highlands.

Wedding cards are sent with the invitations, and are generally made in this proportion, and may be tied together with a ribbon or cord : —


Mr. and Mrs. Edwin Eaton.
Matilda R. Alvrey.

The cards may also be fastened at the top, or made to form one continuous card in connection with the invitation, the wings folding in front, as shown in the diagram : —



LETTERS OF CONDOLENCE.

The occasions on which they are due, and the relations existing between the writers and recipients being so varied, it is impossible to give more than the most general outline for letters of condolence.

It is best to make your letter brief, but earnest and sincere.

Do not endeavor to make light of your friend's misfortune.

If it is loss of worldly goods, speak cheerfully of the future; and do not insinuate that the cause of his present trouble is his own neglect or mistake, as this would be an insult.

Letters of this class should aim to express sympathy, rather than to administer consolation, and, though unpleasant to write, may afford inexpressible comfort to a friend in the hour of affliction.

Letters of condolence on death are generally written upon black-edged paper.

The following are examples: —

To a Friend on the Loss of Property.

Clinton, Nov. 23, 1882.

Mr. Edward Power,
South Bend, Iowa:

My dear Friend, — It gives me great pain to learn that so heavy a misfortune has fallen upon you, and I trust affairs will not prove so bad as they seem at first sight.

If I can be of any service to you, do not fail to call upon me; and, whatever happens, do not forget that I shall ever remain

Your true friend,

Thomas B. Gaynor.

To a Friend on Loss of Home by Fire.

Albany, July 4, 1882.

My dear Mrs. Holmes:

I have just learned of your loss of last evening, and hasten to offer you my sympathy; for, except loss of life, there can be none greater than that of the home, round which so many pleasant memories cling, and in which we have gathered so many household gods, — treasures which no money can replace. I know also what a feeling of desolation must come over you to-day.

Accept my earnest sympathy, and, if I can in any way aid you, do not fail to call upon me.

Yours,

E. A. De Witt.

To a Friend on the Death of His Wife.

Chicago, Aug. 24, 1882.

My dear Mr. Howard:

In so trying an hour as this, consolation must come from that One who presides over all, whose eye neither slumbers nor sleeps.

In the first hours of so great bereavement you will find it hard to see any comfort in such a dispensation; but, remembering the perfect Christian character of your wife, you may later be thankful that the lost one was spared further suffering, and that her pure spirit was taken home without the painful interlude of a long illness.

I will not further intrude upon your privacy, but write at your earliest convenience to

Your most sincere friend,

C. M. Parkhurst.

To a Friend on Death of Husband.

Douglas, Ont., July 19, 1882.

Mrs. Farnum:

My dear Friend,— How little did I think, when I saw your dear husband but a few months since apparently in the best of health, that he, of all others, would so soon receive the last awful summons!

In the midst of your sorrow you can remember that he has left behind him a character for honesty and uprightness which is of more value to his children than untold wealth. If there is any office of friendship which I can perform to assist you in these hours of sadness, do not fail to inform me.

Write me fully in regard to your wishes and intentions, and do not forget that I am, both in adversity and prosperity,

Ever your friend,

Mrs. Emily Choate.

To a Friend on the Death of a Daughter.

GRAND RAPIDS, MICH., Dec. 4, 1882.

MY DEAR FRIENDS:

In this your hour of affliction I can only pray that God, in his infinite goodness and mercy, will comfort and uphold you.

I can well appreciate how the hearts of parents must be bowed down with sorrow at the loss of their first-born. Yet we are told that "whom the Lord loveth he chasteneth," and we can but know that he who has numbered the very hairs of our head would not suffer the slightest grief to come upon us except it were necessary for the accomplishment of his great ends. Let us endeavor to say, "Thy will be done."

With deep sympathy, I am yours,

HATTIE M. HARRINGTON.

To Mr. and Mrs. J. A. PARKER,
Helena, Ark.

To a Friend on the Death of a Son.

MILWAUKEE, WIS., Oct. 2, 1882.

MR. EUGENE EAGAN,
Yankton, New York:

My dear Friend,—It is with deepest sympathy that I write to you, realizing how profound must be the sorrow when he is taken away who, for so many years, has been the comfort and pride of a father's declining life. Still a few more days here, and I trust we will all be united to friends who have been mercifully, no doubt, taken away from us who mourn here below.

I need hardly say that you can now, more than ever, rely upon my aiding you in any way in my power.

Your most sincere friend,

CHARLES D'ORSAY.

To a Friend on the Death of a Sister.

CANTON, LA., May 2, 1882.

MY DEAR FRIEND:

I cannot find words to express to you how deeply I was shocked to hear of the sudden fatal termination of your sister's illness.

I have long enjoyed her friendship, and know how utterly inadequate any words of mine are to soothe the grief which the loss of one so gentle and affectionate must cause. Sometimes I think there may be truth in that old pagan maxim, "Whom the gods love die young."

Praying that Heaven may lighten your sorrow,

I am your friend,

KATE HENWOOD.

To a Friend on the Death of a Mother.

ERIE, PENN., June 2, 1882.

MY DEAR MISS ALDEN:

In times of such peculiar sorrow as yours, it seems almost like intrusion for any but those nearest and dearest to venture upon expressions of sympathy. Still, I should feel myself false to that friendship which I have always felt and expressed for you, if I did not give you some small token of the grief which I experienced when I learned of your recent bereavement. It is so sad a thing to be motherless that I can find no words of comfort to offer you, yet I hope that time may bring "healing on its wings."

Yours,

H. W. FULLER.

To a Friend Suffering from Severe Sickness.

BUFFALO, Jan. 13, 1882.

MY DEAR MR. BRETTON:

It is with sincere regret that I hear of your illness, and I write at once to express my heartfelt sympathy, and most earnest wishes for your speedy recovery. I know that mere words have little power to soothe the long and tedious hours of a sick-room; but I trust, if I can be of any service, you will call upon me freely. Hoping soon to hear of your improvement, I am

Your true friend,

W. H. WHITNEY.

A letter of congratulation should be written at once after the news of any sudden prosperity or good fortune of an intimate friend.

It is desirable to make your expressions of good-will *hearty* and *cheerful*, though care must be taken not to make use of exaggerated terms, as they will cause your letter to appear insincere. Do not hint that a pleasure or prosperity may be short-lived, thereby throwing a cloud over the occasion.

The following are examples of congratulatory letters —

Congratulating a Lady on her Marriage.

St Paul, Minn., May 19, 1882.

My dear Eva

It was with heartfelt pleasure that I learned of your marriage to Mr Howard, and I pray that time may but unite more closely your heart to that of the noble man to whom you have confided your life's happiness

Hoping I may hear from you soon, and that you will pay me a visit on your return,

I remain your old friend and schoolmate

Emily Blanchard.

To Mrs. Eva Howard, Washington, Oregon

Congratulating a Gentleman on his Marriage.

Concord, Mass, Nov. 9 1882

My dear Mr. Allen:

I hasten to offer you my congratulations and sincere good wishes in regard to your recent happiness. I hope that each year may but add to the domestic joys of yourself and estimable wife.

Yours truly,

Mrs. D. J. Wightman.

Congratulating a Friend on the Birth of a Son.

Vernon, Pa., June 19, 1882.

My dear Mr. Gardner:

Allow me to present to you my most hearty congratulations on the birth of your son, and my sincere hopes that he may prove in very truth a blessing to his parents, and the pride and comfort of their old age. As for the little fellow himself, I could wish him no greater happiness than to be born of such parents and in such a home.

Your friend,

John Cullen Bryant.

Congratulating a Friend on Sudden Fortune.

Westfield, N. C., Aug. 24, 1882.

My dear Tom:

Allow me to congratulate you upon your sudden and unexpected good fortune. I am convinced that no one would receive such fortune in a better, wiser, or more humble spirit than yourself; and no one more sincerely rejoices with you on account of it than does

Your faithful friend,

Frank Trott.

Congratulating a Friend on the 25th Anniversary of Wedding.

Melrose, Fla, Sept. 9, 1882.

My dear Mrs. Adams:

If my memory is faithful, it is just twenty-five years to-day since I had the pleasure of congratulating your good husband upon his wedding, and tendering to you my sincere good wishes.

Permit me to congratulate you both upon having completed the silver circle, and offer my best wishes that you may long live together, and experience as much happiness in the future as your faces prove you have enjoyed in the past. With best regards to yourself and husband, I am,

Your friend,

Chas. Oker.

Notes accompanying gifts, and their answers, should be very short, and usually written in the third person.

The answer to the note should be sent at once; but a return present should not be sent too soon, as it will appear as if you were anxious to be rid of an obligation.

The following are examples: —

GENTLEMEN:

Please accept the enclosed trifle which I send you, with the sincere hope that it may help to alleviate the sufferings of the poor. WILLIAM MELLEN.

Note accompanying a Book sent to a Lady.

OAKDALE, KY., Jan. 1, 1882.

Mr. Wallace presents his best wishes to Miss Eliza Gould, and begs that she will accept the accompanying trifle as a memento of the day.

Answer to Foregoing.

OAKDALE, KY., Jan. 2, 1882.

Miss Eliza Gould presents her kindest regards to Mr. Wallace, and tenders him her sincere thanks for his elegant present, which she will take great pleasure in reading.

Among intimate friends, however, a more familiar style is employed, as the following: —

Accompanying a Gift from One Lady to Another.

OAKLAND, CAL., May 2, 1882.

MY DEAR MAY:

Please accept this little token of love and esteem from an old friend. It is but a small proof of my affection, which words are not needed to express, for I am certain you know me to be

Ever your true and loving friend,
EMMA HOWARTH.

Answer to Foregoing.

LONGMEADOW, CAL., May 3, 1882.

MY DEAREST EMMA:

How can I ever thank you sufficiently for your beautiful gift? No proof is wanting of your friendship, which I hope I shall always deserve.

Thanking you from my heart, I am,
Your friend,
MAY BROWN.

Accompanying a Gift on a Young Lady's Birthday.

MAPLE GROVE, DEL., Dec. 4, 1882.

Will Miss Emma Blinn accept this little token, together with the best wishes of her friend for many returns of this her natal day? JULIUS SIFERT.

Accompanying a Basket of Fruit to an Invalid.

NEWARK, N. J., Oct. 9, 1882.

MY DEAR MISS ESTABROOK:

Will you kindly accept the basket of fruit which I send by the bearer? Hoping that you will soon improve in health,

I am,
Yours respectfully,
MRS. H. H. WARMOTH.

Answer to Foregoing.

Newark, N. J., Oct. 10, 1882.

Dear Mrs. Warmoth:

I scarcely know how to thank you for your great kindness in sending me that delicious fruit. Believe me, it was superior to medicine.

Yours,

Mrs J. S. Estabrook.

Accompanying a Present of Music to a Lady.

Wardsboro', Ia., May 2, 1882.

Will Miss Robinson kindly accept the enclosed extracts from her favorite operas, with many thanks for the great pleasure which the giver has derived from her exquisite voice and skilful fingers?

A. Meyers.

Answer to Foregoing.

Wardsboro', Ia., May 3, 1882.

Miss Robinson presents her sincere thanks to Mr. Meyers, and accepts with much pleasure his choice and beautiful selections of music.

LETTERS OF FAVOR.

A letter requesting a favor should be worded as simply and plainly as possible. Do not urge your claim so strongly as to cause your letter to savor of begging, but let your friend see clearly that he will confer a favor by complying.

Asking favors, however, should be avoided as much as possible. This is especially true in regard to money matters. It is a bad habit, worse than running in debt, weakens a man's self-reliance, and may not be agreeable or convenient to his friends, who sometimes, indeed, may not even think it advisable to comply with his request, notwithstanding a refusal is apt to create ill-feeling. A proof of the evil effect is seen in the fact that a very large proportion of the money owing in failures is borrowed from friends. Either lending or borrowing money is generally of questionable benefit.

A letter conferring a favor should be cordial in tone, indicative of real pleasure taken in complying with the request. In granting a money favor, especially if the lender feels that advice would be beneficial, or that stipulations as to payment are advisable, it will be for the interest of both parties to have such definite agreements made as the circumstances require.

When a request cannot be granted, care should be taken to avoid expressions which may tend to wound the feelings.

The following are examples of letters of this class:—

Leadville, Col., April 7, 1882.

Mr. Theo. Chaplin,
Leadville, Col.:

My dear Sir,—Having failed to receive some money which I expected from the East, I am somewhat embarrassed, and would consider it a great accommodation if, without inconveniencing yourself, you would loan me one hundred and fifty dollars ($150) for one month. I will give you my note for the amount, and pay it promptly at maturity.

An immediate answer will greatly oblige

Your friend,

John Goddard.

Answer to Foregoing (favorable).

LEADVILLE, April 8, 1882.

MR. JOHN GODDARD,
Leadville, Col.:

My dear Friend, — Your favor of the 7th inst. received. It gives me great pleasure to be able to serve you. I enclose a check for one hundred and fifty dollars ($150), for which you can send your note at two months.

Yours,
THEO. CHAPLIN.

Answer to Foregoing (unfavorable).

LEADVILLE, COL., April 8, 1882.

MR. JOHN GODDARD,
Leadville, Col.:

My dear Friend, — Yours of the 7th inst. at hand. I regret exceedingly that, being pressed for the payment of a large bill to-morrow, I shall be unable to accommodate you.

Under other circumstances, I should comply with your request with pleasure.

Yours,
THEO. CHAPLIN.

Requesting the Loan of a Book.

LEE, KY., Jan. 21, 1882.

MR. LOUIS FORSAITH,
Lee, Ky.:

Dear Sir, — If you and your friend have finished "Life in Central Africa," will you kindly loan it to me for a short time? I will return it, uninjured, in a few days.

Yours,
NELLIE MARTINET.

Answer to Foregoing.

LEE, KY., Jan. 21, 1882.

MY DEAR MISS MARTINET:

It affords me great pleasure to oblige you. I send the book, hoping you will enjoy it as I have. Trusting you will inform me if you would like other books which my library contains,

I am,
Yours respectfully,
LOUIS FORSAITH.

Requesting the Use of a Horse.

SMITH'S FERRY, UTAH, Jan. 2, 1882.

MR. HENRY TAYLOR.
Smith's Ferry, Utah:

Dear Sir, — As my horse has been quite sick for the past two weeks, I have not been able to use him. Will you allow me to take your sorrel to-morrow afternoon for a trip to Salt Lake?

I will use him carefully and return him before dark

Yours,
J. C. CANNON.

Answer to Foregoing.

SMITH'S FERRY, UTAH, Jan. 2, 1882.

MR. J. C. CANNON,
Smith's Ferry, Utah:

Dear Sir, — My horse is at your service. Peter will bring him over to-morrow at noon.

Yours,
HENRY TAYLOR.

LETTERS OF APOLOGY.

If avoidable, never have occasion to send a letter of apology, but always endeavor to keep your engagements promptly, especially if they are those of business.

If, however, you have been guilty of any impropriety or neglect, the proper and more manly way is to frankly apologize in person. When this is not possible, a letter should be immediately sent.

Let it be a straightforward, sincere apology for the wrong done; and, if any loss or injury was caused, offer to replace or repair it.

The following are examples: —

From a Daughter to her Mother, excusing her Neglect.

GRAND RAPIDS, MICH., Nov. 9, 1882.

MY DEAR MOTHER:

I shall not add to my fault of not writing promptly by trying to justify myself, although there are really some palliating circumstances.

Our kind friends have kept me in a perfect whirl of pleasant visiting and sight-seeing, so that in the evening I have felt completely tired and anxious to get some repose. Hereafter I will *make* time to perform what really is a great pleasure, no less than a duty, and you may expect a letter from me at least once a week.

Remember me kindly to auntie, and all the friends who remember and inquire about the well-being of

Your loving daughter,

LAURA.

Apologizing for breaking a Business Engagement.

PALMER'S HOTEL, BALTIMORE, MD., Aug. 3, 1882.

MR. R. P. HUNTLEY,
14 Charles St., Baltimore, Md.:

Dear Sir, — I am very sorry to be compelled to apologize for my failure to meet you last evening as agreed, but the dangerous illness of my little boy made it impossible for me to do so.

I hope that it did not seriously inconvenience you, and that you will appoint another meeting, at which I will endeavor to be prompt.

Yours,

GEO. M. DALLAS.

Apologizing for Failure to return a Borrowed Book.

LAKE PLEASANT, R. I., Dec. 3, 1882.

MY DEAR MRS. PRESTON:

I return by bearer the book of poems which you so kindly loaned me, and for which you sent this morning.

I know that I have been guilty of great negligence in delaying so long to return it; but I trust that you will pardon me, as I have been away from home. Thanking you for your kindness,

I am yours,

NELLIE WASHBURNE.

LETTERS OF ADVICE.

Letters of advice should be written with great care, as, even when written with the best motives, they sometimes give offence. Be careful that no selfishness appears in your letter, but let your advice be purely disinterested.

The following are examples: —

Letter from Benjamin Franklin to a Young Lady.

MY DEAR FRIEND:

I send you the books I mentioned last evening. I beg you to accept them as a small mark of my esteem and friendship. They are written in the familiar, easy manner for which the French are so remarkable, and afford a good deal of philosophic and practical knowledge unembarrassed with the dry mathematics used by more exact reasoners, but which are apt to discourage young beginners. I would advise you to read with a pen in your hand, and *enter in a little book short hints of what you find* that is *curious or that may be useful;* for this will be the best method of imprinting such particulars on your memory, where they will be ready either for practice on some future occasion, if they are matters of utility, or at least to adorn and improve your conversation if they are rather points of curiosity. And as many of the terms of science are such as you cannot have met with in your common reading, and may therefore be unacquainted with, I think it would be well to have a good dictionary at hand to consult immediately when you meet with a word you do not comprehend the meaning of.

This may seem at first troublesome and interrupting, but it is a trouble that will daily diminish as you daily find less and less occasion for your dictionary as you become more acquainted with the terms; and in the mean time you will read with more satisfaction, because with more understanding.

When any point occurs in which you would be glad to have further information than your book affords you, I beg you would not in the least apprehend but that I should think it a pleasure, and no trouble, to assist you. For, though I may not be able out of my own little stock of knowledge to afford you what you require, I can easily direct you to the book where it may most readily be found.

Adieu, and believe me ever, my dear friend,

Yours affectionately,

BENJAMIN FRANKLIN.

Carlyle's Advice to Young Men.

The following admirable letter by Thomas Carlyle, Esq., was addressed to a young man who had written to him desiring his advice as to a proper choice of reading, and, it would appear also, as to his conduct in general. We earnestly recommend it to the attention of our readers, as containing advice of the most valuable and practical description, and pregnant with truths with which they cannot be too well acquainted.

The young are too much inclined to be dissatisfied with their actual condition, and to neglect their immediate duties in vain aspirations after others beyond their lot; and they need the monitions of such a kind but vigorous and emphatic adviser as Mr. Carlyle, and to have it impressed upon their minds that

"To do
That which before us lies in daily life
Is the prime wisdom."

DEAR SIR, — Some time ago your letter was delivered me; I take literally the first free half-hour I have had since to write you a word of answer.

It would give me true satisfaction could any advice of mine contribute to forward you in your honorable course of self-improvement, but a long experience has taught me that advice can profit but little; that there is a good reason why advice is so seldom followed, — this reason, namely, that it is so seldom, and can almost never be, rightly given. No man knows the state of another: it is always to some more or less imaginary man that the wisest and most honest adviser is speaking.

As to the books which you — whom I know so little of — should read, there is hardly anything definite that can be said. For one thing, you may be strenuously advised to keep reading. Any good book, any book that is wiser than yourself, will teach you something, — a great many things, indirectly and directly, if your mind be open to learn. This old counsel of Johnson's is also good, and universally applicable: "Read the book you do honestly feel a wish and curiosity to read." The very wish and curiosity indicate that you, then and there, are the person likely to get good of it. "Our wishes are presentiments of our capabilities"; that is a noble saying, of deep encouragement to all true men, applicable to our wishes and efforts in regard to reading as to other things.

Among all the objects that look wonderful or beautiful to you, follow with fresh hope the one which looks wonderfulest, beautifulest. You will gradually find by various trials (which trials see that you make honest, manful ones, not silly, short, fitful ones) what *is* for you the wonderfulest, beautifulest, — what is *your* true element and province, and be able to profit by that. True desire, the monition of nature, is much to be attended to. But here also you are to discriminate carefully between *true* desire and false.

The medical men tell us we should eat what we *truly* have an appetite for; but what we only *falsely* have an appetite for we should resolutely avoid. It is very true; and flimsy, desultory readers, who fly from foolish book to foolish book, and get good of none and mischief of all, — are not these as foolish, unhealthy eaters, who mistake their superficial false desire after spiceries and confectioneries for their real appetite — of which even they are not destitute, though it lies far deeper, far quieter — after solid nutritive food? With these illustrations, I will recommend Johnson's advice to you.

Another thing, and only one other, I will say. All books are properly the record of the history of past men, — what thoughts past men had in them, what actions past men did: the summary of all books whatsoever lies there. It is on this ground that the class of books specifically named History can be safely recommended as the basis of all study of books, — the preliminary to all right and full understanding of anything we can expect to find in books. Past history, and especially the past history of one's own native country, everybody may be advised to begin with that. Let him study that faithfully: innumerable inquiries will branch out from it; he has a broad-beaten highway, from which all the country is more or less visible; there travelling, let him choose where he will dwell.

Neither let mistakes and wrong directions — of which every man, in his studies and elsewhere, falls into many — discourage you. There is precious instruction to be got by finding that we are wrong. Let a man try faithfully, manfully, to be right, he will grow daily more and more right. It is, at bottom, the condition on which all men have to cultivate themselves. Our very walking is an incessant falling, — a falling and a catching of ourselves before we come actually to the pavement! it is emblematic of all things a man does.

In conclusion, I will remind you that it is not by books alone, or by books chiefly, that a man becomes in all points a man. Study to do faithfully whatsoever thing in your actual situation, there and now, you find either expressly or tacitly laid to your charge: that is your post; stand in it like a true soldier. Silently devour the many chagrins of it, as all human situations have many; and see you aim not to quit it without doing all that *it* at least required of you. A man perfects himself by work much more than by reading. They are a growing kind of men that can wisely combine the two things, — wisely, valiantly, can do what is laid to their hand in their present sphere, and prepare themselves withal for doing other wider things, if such lie before them.

With many good wishes and encouragements, I remain yours sincerely,

Thomas Carlyle.

Chelsea, 13th March, 1843.

Franklin's Advice to a Young Tradesman. Written in the Year 1748.

As you have desired it of me, I write the following hints, which have been of service to me, and may, if observed, be so to you.

Remember that time is money. He that can earn ten shillings a day by his labor, and goes abroad or sits idle one half of that day, though he spend but sixpence during his diversion or idleness, ought not to reckon that the only expense: he has really spent, or rather thrown away, five shillings besides.

Remember that credit is money. If a man lets his money lie in my hands after it is due, he gives me the interest, or so much as I can make of it, during that time. This amounts to a considerable sum where a man has good and large credit, and makes good use of it.

Remember that money is of a prolific, generating nature. Money can beget money, and its offspring can beget more, and so on. Five shillings turned is six; turned again, it is seven and threepence; and so on till it becomes a hundred pounds. The more there is of it, the more it produces every turning, so that the profits rise quicker and quicker. He that kills a breeding sow destroys all her offspring to the thousandth generation. He that murders a crown destroys all that it might have produced, even scores of pounds.

Remember that six pounds a year is but four pence a day. For this little sum (which may be daily wasted either in time or expense, unperceived) a man of credit may, on his own security, have the constant possession and use of a hundred pounds. So much in stock, briskly turned by an industrious man, produces great advantage.

Remember this saying, "The good paymaster is lord of another man's purse." He that is known to pay punctually and exactly to the time he promises may at any time, and on any occasion, raise all the money his friends can spare. This is sometimes of great use. After industry and frugality, nothing contributes more to the raising of a young man in the world than punctuality and justice in all his dealings: therefore never keep borrowed money an hour beyond the time you promised, lest a disappointment shut up your friend's purse forever.

The most trifling actions that affect a man's credit are to be regarded. The sound of your hammer at five in the morning, or nine at night, heard by a creditor, makes him easy six months longer; but if he sees you at a billiard-table, or hears your voice at a tavern, when you should be at work, he sends for his money the next day,—demands it before he can receive it in a lump.

It shows, besides, that you are mindful of what you owe; it makes you appear a careful as well as an honest man, and that still increases your credit.

Beware of thinking all your own that you possess, and of living accordingly. It is a mistake that many people who have credit fall into. To prevent this, keep an exact account, for some time, both of your expenses and your income. If you take the pains at first to mention particulars, it will have this good effect: you will discover how wonderfully small trifling expenses mount up to large sums, and will discern what might have been and may for the future be saved, without occasioning any great inconvenience.

In short, the way to wealth, if you desire it, is as plain as the way to market. It depends chiefly on two words, *industry* and *frugality*; that is, waste neither *time* nor *money*, but make the best use of both. Without industry and frugality nothing will do, and with them everything. He that gets all he can honestly, and saves all he gets (necessary expenses excepted), will certainly become *rich*, if that Being who governs the world, to whom all should look for a blessing on their honest endeavors, doth not in his wise providence otherwise determine.

BENJAMIN FRANKLIN.

Advising a Young Man not to abandon the Study of a Profession.

WILKESBARRE, PENN., Feb. 6, 1882.

DEAR PARKER:

Your letter announcing your sudden change of fortune, and asking my advice in regard to finishing your law studies, has just reached me.

You say that your unexpected legacy will place you above the necessity of earning a support, and seem to consider it time wasted to still study for admission to the bar.

My dear boy, my advice to you is to continue your studies by all means. You are well aware of the uncertainty of riches in this country. The millionnaire of to-day may be the bankrupt of to-morrow; but the man who has a profession or a trade is independent of the reverses of fortune.

Even supposing your wealth to be so safely invested as to be thoroughly secure, believe me, a life of idleness will not prove one of happiness.

You have asked my advice, and I give it to you freely. Let me earnestly and sincerely assure you that it is best for you in every way to continue your studies.

With hearty congratulations upon your improved prospects,

I am yours, etc.,

CHARLES FIELD.

To PARKER BARNES,
Harrisburg, Pa.

From a Young Lady remonstrating with her Intended Husband on his Reckless Life.

NASHVILLE, TENN., Oct. 19, 1882.

MY DEAR FRED:

It is with pain that I am obliged to write words so different from those I have hitherto been accustomed to address to you; but I feel that, between persons who are to share their whole lives in common, nothing but unqualified sincerity should exist, and I therefore venture at once to speak my whole mind on a subject of vital importance to us both.

I have observed of late a sad change in your habits, language, and associates. Since we were together at Baltimore, you appear to have acquired a taste for companionship which is neither natural to your disposition, nor calculated to qualify you for domestic life.

Remember, my dear Fred, that our outset in life will be a humble one, and that economy and perseverance are our main resources if we hope to arrive at a state of competency.

Be yourself, my dear Fred; embrace again the sound and manly principles which have hitherto been yours, and abandon a class of society which can only unsettle your disposition and destroy your prospects.

I feel assured that your natural goodness of heart, and the affection you have so often plighted to me, will cause you to take this remonstrance in good part; and that you will not think ill of one who advises you, not as being older or more experienced than yourself, but as loving you with a sincerity that alone could have prompted this address.

God bless you, my dearest, and grant that we both may be able to amend our own faults and bear with each other.

Yours most affectionately,
CLARA.

To FRED MONKS, Esq.,
Louisville, Ky.

FAMILY LETTERS.

Letters of this class should be easy and graceful in their style, and may often be enlivened by playful allusions, jests, and familiarities.

The most elegantly expressed composition will not bring one half the pleasure to a far-away relative that may be found in the simple letter overflowing with feelings of home life and home love.

The writer may speak of many trivial things at and about home, and the gossipy matters of the neighborhood; keeping the absent one informed upon all minor facts and occurrences, as well as upon the more important ones, concluding with sincere expressions of affection from various members of the family.

The absent one should in like manner express himself freely upon all subjects; describe his journey and present surroundings minutely, speaking especially of what may have interested him. In short, a family letter should be written without any regard to showy or dignified composition.

The following are examples:–

From a Boy in the Country to his Brother at Home.

GUILFORD SPRINGS, VT., June 20, 1882.

MY DEAR BROTHER TOM.

I must apologize for not having written to you before, but I have hardly had a quiet moment since I reached here.

You remember cousin Frank came at the same time I did; and we found two friends of uncle had also sent their boys down for a month, so you can imagine how we enjoy ourselves.

There are horses, cows, pigs, chickens, and all sorts of domestic animals on the farm, and I find great sport in watching them. Sometimes I have jokes made at my expense on account of my ignorance of country life; but they are all in good-nature, and occasionally I repay them with interest.

Long before your sleepy eyes are opened in the morning, we are out, having eaten our breakfasts, and are ready for a day's sport. Uncle has allowed us to assist (?) the men, and I tried to mow; but the scythe *would* go straight into the ground.

Wild blackberries and raspberries grow in profusion about a quarter of a mile from the house, and we find fish in plenty in the little streams around here.

We, with the boys on the neighboring farms, get up picnic parties; walking off with auntie's biggest basket stuffed full of cold meats, cakes, eggs, and all sorts of good things, till we find a shady spot where we can fish or play ball. There we camp for the day, returning home at dusk, all ready for the good suppers and comfortable beds which we know are waiting for us.

I caught a wild rabbit last week in a trap and am trying to tame him, but he appears very much frightened at the new home which I have made him from a dry-goods box.

Frank is calling to me, and the others are nearly ready to start for Mr. Sampson's farm, where we are invited to spend the day. Remember me to all the boys and write soon.

Your affectionate brother,

Mr. Thomas Williard, Henry Williard.
Walpole, N. H.

Dr. Franklin to his Wife.

Easton, Nov. 13, 1756.

My dear Child:

I wrote to you a few days since by a special messenger, and enclosed letters for all our wives and sweethearts, expecting to hear from you by his return, and to have the Northern newspapers and English letters per the packet; but he has just now returned without a scrap for poor us. I had a good mind not to write you by this opportunity, but I never can be ill-natured enough, even when there is the most occasion.

The messenger says he left the letters at your house, and saw you afterwards at Dr. Duche's, and told you when he would go, and that he lodged at Hovey's, next door to you, and yet you did not write; so let Goody Smith give one more just judgment, and say what shall be done with you.

I think I won't tell you that we are all well, nor that we expect to return about the middle of the week, nor will I send you a word of news, — that 's Poz.

My duty to mother, love to children and to Miss Betsy and Gracy, etc., etc.

I am your loving husband,

Benjamin Franklin

P. S. — I have scratched out the loving words, being written in haste by mistake when *I forgot I was angry.*

Wm. Cowper, Esq., to his Cousin, Mrs. Cowper.

May 10, 1770.

My dear Cousin:

I do not write to comfort you (that office is not likely to be well performed by one who has no comfort for himself), nor to comply with an impertinent ceremony which in general might well be spared upon such occasions, but because I would not seem indifferent to the concerns of those I have so much reason to esteem and love.

Believe me, I sorrow deeply for your brother's death. When I knew him he was much beloved, and, I doubt not, continued to be so.

To live and die together is the lot of a few happy families, who hardly know what a separation means, and one sepulchre serves them all, but the ashes of our kindred are indeed scattered.

Whether the American gulf has swallowed up any others of my relatives I do not know, but it has made many mourners.

Believe me, my dear cousin, though after a long silence which perhaps nothing else than the present trouble could have prevailed with me to interrupt, as much as ever

Your affectionate kinsman,

Wm. Cowper.

Sir Humphrey Davy to his Mother.

Hot Wells, Nov. 19, 1800.

My dear Mother:

Had I believed my silence of six weeks would have given you a moment's uneasiness, I should have written you long ago; but I have been much engaged in my favorite pursuit of experimenting, and in endeavoring to amuse two of my friends who have spent some days at the institute.

One of them is your quondam lodger, George Watt, who desired to be kindly remembered to you and to the family. The other you have heard me speak of: his name is Thompson, and he is one of the few to whom God has given a spirit carrying them above the common things of this world.

Accept my affectionate thanks for your presents. I have received them all, and have made good use of them.

Several times has a supper on the marinated pilchards made me recollect former times, when I sat opposite you, my dear mother, eating of the same delicious food and talking of future unknown things.

Little did I then think of my present situation, or of the mode in which I am, and am to be, connected with the world. Little did I then think that I should be so long absent from the place of my birth as to feel such longings as I now feel for visiting it again.

I shall see with heartfelt pleasure the time approaching when I shall again behold my first home, when I shall endeavor to repay some of the debts of gratitude I owe to you and to my aunts.

My next visit shall not be so short a one as my last. I will stay with you at least two or three months.

You have let half your house: have you a bedroom reserved for me and a little room for a laboratory? Which part have you let?

When I come to Penzance I will settle all about John; till then I should like him to learn French and Latin with Mr. Dugart. The expense of this, or any other part of his education, I shall be glad to defray.

Do not, by any means, put him with Mr. Coryton.

The paints I have long since procured, and, if there is no vessel in the course of a week, they shall be sent off by the wagon.

I will write to Kitty in the course of next month.

I am very glad to hear Grace is better. Remember me with affection to her. I have not yet seen Mr. Griffin, but any one who has lately seen my friends I shall be glad to see.

All in the way of progress goes nobly. My health was never better than since I left Cornwall last.

I shall be very glad to hear from you soon. You have a hundred subjects to write about which are interesting to me; I can only write of myself.

Remember me with affection to all my friends, particularly the doctor. Love to Kitty, Grace, Betsy, and John.

Farewell, my dear mother.

Your affectionate son,

HUMPHREY DAVY.

Matilda Dawson to her Father.

BRIGHTON, SUSSEX, Oct. 4, 1839.

MY DEAR FATHER:

How shall I express to you my thanks for your generous remembrance of me on my birthday? The gift itself was scarcely more valuable than the kind and delicate manner of its conveyance. To possess a portrait of my beloved and lamented mother has long been an object of my desire. Be assured I shall value it as a great treasure.

I cannot hope to fill the vacant place in our once complete domestic circle; but I do trust the valuable instructions I am receiving here will in some measure qualify me to take the superintendence of your household and the charge of my little brothers. It will afford me great delight to repay in offices of love and duty the affectionate and devoted kindness with which you have watched over me. My kind and considerate governess has appeared especially to adapt her advice to me in regard to the responsible position I am shortly to occupy; and you will, I know, bear with much that is deficient in me.

Let me assure you my earnest endeavors shall not be wanting to manifest, by attention to your comfort, my sense of your paternal care.

Your affectionate daughter,

MATILDA DAWSON.

From a Youth in City to Sister in Country.

WASHINGTON, D. C., Feb. 2, 1882.

DEAR HATTIE :

I have written to mother three times since coming here ; but, as I promised to write to you also, I will keep my word now. I waited until I should have something to write about, and now, if I were to scribble for a week, I could not tell you all that I have seen

Father has to be at the Capitol so much that I soon found, if I depended upon him to take me about the city, I should see very little ; so I have learned the way about by myself, and am having a splendid time.

Yesterday, I went to the Patent Office ; and, O Hat! it makes me fairly dizzy to see the articles that have been invented in this country. I was proud to be an American when I looked at the proof of the brains and genius of my countrymen I cannot begin to tell you what I saw.

Tell mother there is a patent machine here that winds up like a clock, and will churn the butter and rock the cradle at the same time! How would she like that? There is a rotary harrow that even father gets excited over. There is a machine for knitting stockings that would make grandma open her eyes ; and, Hat, you would like one of the hatching beds that would hatch out chickens enough to satisfy even you.

I saw all General Washington's household and camp property, and all the presents which foreign governments have given to our Presidents. .

I have been all over the Capitol, and heard long debates both in the Senate and House of Representatives. Between you and me, Hat, they were rather tedious and bewildering ; but father looked so astonished when I said I was tired, that I was ashamed ever to repeat the assertion.

This evening, I am going to the theatre, and, as I must be all ready at teatime, I cannot write any more now. Answer this, dear Hattie, then you shall have another long letter from

Your loving brother,

ROBERT.

LETTERS OF AFFECTION.

There is no class of letters which consume so much time and thought, and are a source of so much anxiety to their writers, as love-letters.

Those, however, which come from the heart need but little guidance in regard to composition, as, where the feelings are really interested, the words will flow easily from the pen.

Never indulge in extravagant flattery or protestations of affection, as this tends to create disgust and a doubt of the writer's sincerity.

Always endeavor to be straightforward, remembering the first element of lasting love is respect.

The charm of correspondence arises from the degree of congeniality in taste, and from the tone of earnest love which is given to the whole. Still, of all letters, these should be most carefully prepared, as they are most thoroughly read and reread, the longest preserved, and the most likely to be regretted in after-life.

Ladies especially should be very careful to preserve their dignity, as, even if an engagement exists between the parties, some cause may break it and the feelings be entirely changed.

She can rest assured that her betrothed will esteem her more for a quiet, affectionate dignity in writing, than if she were too lavish of her most sacred feelings.

Yet a love-letter should be free from all constraint and stiffness.

Write as you would talk to the object of your affections, and, above all, be honest in the expression of your sentiments.

Good sense will always dictate a proper amount of reserve; but, when caution has to be exercised, it were better not to write the letter.

From a Gentleman to a Lady, requesting Permission to call.

No. 6 Sylvan Park, Trenton, N. J., Jan. 11, 1882.

Dear Madam:

Since I have had the pleasure of meeting you a number of times at the house of our friend Mrs. Lovelace, I venture to write begging permission to call upon you at your own residence.

Trusting you will pardon the liberty I take, and allow me a place among your circle of gentlemen friends, I am

Very respectfully yours,

George Dickerman.

To Miss Julia Bettison,
17 Delaware Street, Trenton, N. J.

From a Gentleman to the Father of a Lady, requesting her Hand in Marriage.

No. 356 Greenwood Ave., Bridgeport, Conn., June 11, 1882.

Mr. Charles Howard,
Bridgeport, Conn.:

My dear Sir, — I am certain you will not be surprised when I tell you that, through my frequent visits at your house and your kind hospitality to me, I have learned to regard your daughter with a most sincere affection Knowing that her welfare and happiness must be the first consideration with you, I hasten to acquaint you with my feelings.

I am, as you are aware, not lacking in this world's goods; and, if an honest and sincere affection can secure her happiness, these certainly shall not be wanting. Will you trust her to me? I anxiously await your answer.

Very respectfully,

W. H. Frothingham.

From Father in Reply.

No. 44 Elm St., Bridgeport, Conn., June 12, 1882.

Mr. W. H. Frothingham,
356 Greenwood Ave., Bridgeport, Conn.:

My dear Sir, — Your frank and manly letter reached here this morning. It is only with feelings of greatest sadness that a father can part with the child who has been so long his pride and comfort, though I know of no one to whom I would sooner confide the future of my daughter, and no one whom I would sooner receive as a son, than yourself.

Hoping to see you here at your earliest convenience,

I am yours,

Charles Howard.

From a Gentleman to a Lady offering her his Hand in Marriage.

White Springs, Ark., July 2, 1882.

My dear Miss Knights:

You must have been aware that, for some time past, my feelings toward you have been stronger than those of mere friendship.

Our long acquaintance has given me ample opportunity to learn the many excellences of your character, and has also afforded you an opportunity to judge whether I possess those characteristics which you would desire in a husband.

I have made known my intentions to your father, and have received his kind approval. Am I presumptuous in hoping you will consent to become my wife?

Yours truly,

Benjamin Freeman.

Lady's Answer (favorable).

St. Louis, Mo., July 3, 1882.

My dear Mr. Freeman:

Your letter to me was a surprise, yet a very pleasant one, for it gave me great happiness. I will say to you, as frankly as you confessed your affection for me, that I reciprocate your sentiments, and will strive to be to you all that you can desire.

I shall be pleased to see you when you can make it convenient to call.

Yours sincerely,

Alice Knights.

Lady's Answer (unfavorable).

St. Louis, Mo., July 3, 1882.

Mr. Freeman:

Dear Sir, — Your letter, which I have just received, has caused me the deepest pain; for I fear lest I may have unconsciously caused you to hope for what can never be a reality.

Believe me, it was from no spirit of coquetry, but because I valued your friendship and believed I was to you only a friend. And, while I cannot partake in the affection which your letter offered me, I fully appreciate the great honor which you do me, and shall always prize your friendship, which I hope not to be deprived of.

Trusting at a future day you may find some heart beating responsive to your own, and may give to a loving wife that sincere love of which any woman may be proud,

I am your sincere friend and well-wisher,

Alice Knights.

The *Washington Republican* recently offered a prize for the best letter accepting an offer of marriage, and here is a copy of the letter which won the prize: —

My dear Donald:

Fresh with the breath of the morning came your loving missive. I have turned over every leaf of my heart during the day, and on each page I find the same written; namely, gratitude for the love of a noble man, humility in finding myself its object, and ambition to render myself worthy of that which you offer. I will try.

Yours henceforth,

Gertrude.

Letters of this class are, however, often very informal, as the following. —

My dear Nellie:

I love you. Will you be my wife?

Yours most affectionately,

Charlie.

Answer to Foregoing.

My dear Charlie:

With the greatest pleasure.

Yours with like affection,

Nellie.

From a Gentleman asking Release from an Engagement.

No. 1418 Broad St., Philadelphia, Nov. 13, 1882.

Miss Mattie Miller:

When I asked you three months ago to be my wife, I believed our tastes were congenial and that I could make you happy. The closer intimacy of an engagement has proven to me my error; and I find that, both in disposition and desires, we are in many ways unsuited for each other, and I can foresee only a life of misery for both after marriage.

I know that honor binds me to you, and therefore will not ask for my release if you do not desire it, but will, if we marry, endeavor faithfully to make you happy by every means in my power.

Ever your friend,

JOSHUA THAXTER.

To Miss MATTIE MILLER,
4144 Arch St., Philadelphia, Pa.

From a Lover before starting on a Journey.

SOUTH BEND, IND., Aug. 3, 1882.

MY DARLING CLARA:

News has just reached here which makes it necessary for me to start immediately for Salt Lake City, there to remain some weeks. I will write you at once on reaching there, and send you my address, when I shall expect a long letter from my little wife (in prospective).

Regretting that my hasty departure prevents my bidding you good-by in person, I am

Most affectionately yours,

T. B. FITZ.

ADVICE BUSINESS LETTERS

THE cardinal characteristics of business correspondence are CLEARNESS, BREVITY, and NEATNESS. The letter should be written in clear and comprehensive language, and divided into paragraphs, each one treating of a separate subject.

It should also be as brief as is consistent with a perfect understanding of the subject treated, all personal matters being carefully excluded, as, with business men, time is money, and while in the counting-room they have no time for unnecessary letter-reading. (*Business letter-writing* is here given: but there is advice, and may be points or letters bearing on business, in the social letters; so the business student should study the whole subject carefully.)

Neatness, particularly in regard to the legibility of the handwriting and the form in which the information is communicated, impresses the business man of long standing (whose counting-room is well arranged and whose books are carefully kept) with a high opinion of his correspondent's method of carrying on his mercantile transactions.

The reply should correspond in tone to the original, and follow its order in the treatment of the subject.

The most important evidence in regard to a business transaction, should any error or dispute arise during its progress, is an autograph letter.

For this reason, all business letters should be preserved with the greatest care, being arranged and indorsed so that any one can be found at a moment's notice.

Every business man should also keep a letter-book, in which all letters sent away are to be transcribed by means of a copying-press.

This book, for the sake of reference, should be folioed and indexed, so that, when a letter is written, an entry can be made in the index of the name and address of the person written to.

Sometimes, however, when for any reason it is not practicable to have a letter-book, a kind of diary is made use of, in which a summary of the contents of all letters despatched is made, thus:—

1882, Aug. 4.—Wrote Gately & Conroy, Cincinnati.
Ordered 300 albums @ $9.
Enclosed check on National Bank.
Explained delay in sending goods.

This entry is, however, sometimes made in the blotter or day-book.

The stationery generally used for business purposes is half-sheet commercial note or letter-paper, with envelopes to correspond in width and color.

In the upper left-hand corner of the envelope the address of the firm writing is generally printed, with a request that it be returned to the sender if not delivered within five or ten days.

Often, however, no time is mentioned, when the postmaster will hold the letter thirty days before returning.

Most firms, especially if doing an ordinary or large business, have their address and kind of business printed upon the upper part of their letter-paper in a similar manner as upon their bill-heads and receipts, thus:—

DOWD & BUCKLEY,
IMPORTERS, PUBLISHERS, AND BOOKSELLERS,
No. 908 *Chestnut Street,*
NEW ORLEANS, LA., 188

Where this printed address is not used, it should be written, together with the date, on the right-hand side of the first and second lines of the sheet; and the name and address of the person or firm written to should be placed one line below on the left side, the complimentary address being on the next line on the same side, thus:—

No. 225 HARRISON STREET,
ST. PAUL, MINN., Aug. 30, 1882.

MESSRS. ALDEN & SMITH, ST. LOUIS, MO.
Gentlemen:
In reply, etc.,

When the address has once been given at the opening, whether printed or written, it is not repeated at the close.

Always answer promptly all business letters.

ORDERING GOODS.

In ordering goods, whenever it is possible, allow ample time for filling your own orders, but endeavor to reply to all letters received on the same day.

As time is an object in all kinds of business, it is customary in writing to use abbreviations for mercantile terms, which are well known (the principal ones are given in the book-keeping department of this work).

The names of the months are sometimes abbreviated, as elsewhere stated. Often, for greater brevity, the month is denoted by its number; and in that case *December* would be represented by 12, as it is the twelfth month: thus, if I desire to date my letter *December* 19, 1882, I should put it 12/19, '82.

ANSWERING LETTERS.

As most merchants do not personally answer their letters, the task is assigned to some one or more corresponding clerks.

Such a position is a responsible one and requires ability, as a merchant may have several hundred letters to examine and have answered. Notes or comments are generally made by the principal or clerk on each letter as read, to indicate the answer to each particular part, or to the general tenor of the letter.

This is done because a clerk would otherwise find it hard to remember just what was to be said in reply to each letter; and in this connection it would be well to remember that a clerk should always endeavor to get the substance of the principal's remarks, and, as near as possible (unless otherwise instructed), in the language of the principal, as, if not, the answers may not convey the idea which was intended, and thereby cause trouble, loss of time, and in some cases serious injury. It is on this account principally that capable phonographers are being employed in large business houses, as the shorthand writer can take down comments as fast as they are given, and afterwards he can translate his notes into the usual form of letters. (See article on "Shorthand.")

The business man thus knows that what he has to say will be transmitted, as near as may be, in his own language, and with no danger of having his intentions thwarted.

MARKING LETTERS RECEIVED.

It is customary in answering letters, especially when no letter-book is used or record otherwise kept, to mark on the upper part of the letter received, under the date, when and by whom answered; and sometimes a brief abstract of the answer is also noted.

This is a triple safeguard, for it shows that the letter has been answered, by whom, and the tenor of the reply sent.

RETURNING ANSWER ON LETTER RECEIVED.

There are cases where, to save time and have a certain lot of facts bearing on a subject all together, — so that one will explain another without having to hunt up the last letter on the same matter, — the answer is written on the back of the letter received; as, for instance, I send on June 10 a bill of collection, by Uniac's express, on W. Everdue, for $25, and, the money not coming, I write the express company to this effect: —

St. Augustine, Fla., July 3, 1882.

Uniac's Express Co.:

Gentlemen, — Please report on B. C. on W. Everdue, of Savannah, sent from this office June 10, and oblige

Yours,

Hummel & Elmore.

The express company will return that letter with all their agents' reports thereon, thus giving the reason of the delay; and so it is in corresponding with any department of the government.

If you address a letter of inquiry to the War Department, your letter will be returned to you covered with the comments of the various officials to whom it has been referred: your answer will thus be in the most concise form possible. This method is also adopted by nearly all the large corporations in the country.

The following are examples of business letters: —

LETTERS ANSWERING BUSINESS ADVERTISEMENTS.

A letter answering an advertisement should first name the date of the advertisement, in what paper it appeared, and the substance of the article.

There is perhaps no better way than to clip it out, and fasten neatly at the top of your letter, thus preventing every possible chance for mistake.

Make your answer as brief as possible, saying very little about yourself, except to give your experience and qualifications if necessary, and mentioning with care your references, which will speak for you far more effectually than you can speak for yourself.

Answer as soon as possible after seeing the advertisement, as promptness will often secure you a consideration in advance of those who may have delayed.

And lastly, write carefully, using care in regard to the neatness and spelling of your letter: for, if the position which you seek be at all desirable, there may be many applicants; and, with nothing further from which to judge of your habits, a blot, or error in spelling, may condemn your application.

These letters must always be written by yourself, as any attempt at deceit in this respect will soon be detected and place you in a very bad light.

If you have written testimonials from those by whom you have been previously employed, you may enclose copies, stating that they are such; but never send the originals, as they are liable to be lost.

Answering an Avdertisement for Salesman.

Denver, May 1, 1882.

Messrs. Merwin & Co., No. 390 Dixwell Ave. :

Gentlemen, — I saw your advertisement for salesman in the *Herald* of this morning, and would beg to apply for the position which you offer. I am thoroughly acquainted with the boot and shoe business, having been in the employ of Messrs Hosmer, Codding & Co., of this city, during the past eight years. I enclose you copies of testimonials furnished me by them, and would also refer you to Mr. S. R. Huges, No. 39 Merchants' Row, this city.

Hoping to hear from you in reply, I am,

Yours respectfully,

Herbert Allen.

Answer to Advertisement for Coachman.

[Advertisement fastened at top.]

Wanted. — A young man of good character as coachman; must thoroughly understand the care of horses and come well recommended.

Address with references "J.," 192 *Globe* office.

Toledo, May 21, 1882.

"J.," 192 *Globe* office :

Sir, — In reply to the above advertisement taken from the *Globe* of this morning, I would respectfully offer my services. I am well acquainted with the care of horses, having been for three years in the employ of Dr. W. R. Whitney, No. 24 Winthrop Avenue. I am also permitted to refer to Mr. Horace Burns, No. 19 Harvard Street. I am married and have a small family, which I should prefer to have with me, but would try to make any arrangement satisfactory to you.

Respectfully yours,

R. C. Hitchcock, No. 137 East Water Street.

Answer to an Advertisement for an Office Boy.

[Advertisement fastened at top.]

WANTED. — A boy, to grow up in the office of a wholesale house; must be a good penman, and reside with his parents in the city; salary first year, $100.

Address, in own handwriting, P. O. Box 376, Columbus, O.

COLUMBUS, March 1, 1882.

P. O. Box 376:

Dear Sir, — Seeing your advertisement in to-day's *Journal*, I write to offer my services for the situation. I am sixteen years old, and reside with my parents at 136 Temple Street. I would refer you to Mrs. James Bryant, No. 1023 Washington Street, from whom I enclose the following copy of testimonial.

Yours very respectfully,

EDWARD H. PRICE.

Answer to Advertisement for Book Agent.

CHICAGO, Aug. 24, 1882.

GATELY & HASKELL, Hoen Block, Baltimore, Md.:

Gentlemen, — In response to your advertisement in this evening's *Herald* for canvassers on your new work, I would respectfully tender my services. I have had nearly four years' experience in work of this kind, having been employed by Bair & Dillon, from whom I enclose you copy of testimonial. Hoping to hear from you in reply, I am

Yours respectfully,

CHARLES HODGKISS, No. 11 Haywood Street.

Answer to Advertisement for Music Teacher.

PARK INSTITUTE, Sept. 3, 1882.

PROF. J. H. HOWARD:

Dear Sir, — Having noticed your advertisement in the *Globe* of this evening, I write to offer my services for the situation of music teacher in your seminary.

I am a graduate of the New York Conservatory of Music, and have been teaching at this Institute during the past two years; and would refer you to the principal, Prof. Henry L. Wilson.

I also have many testimonials of the satisfaction of the parents of those who have been under my instruction here. Hoping to hear from you soon, I am

Yours respectfully,

EDITH ROBERTS.

Answering an Advertisement for Apprentice to a Dressmaker.

[Advertisement fastened at top]

BRATTLEBORO', Dec. 4, 1882.

MRS. D. D. PERRY:

In answer to the above advertisement, I would respectfully apply for the situation.

I have recently been left alone and dependent on my own exertions for support; am eighteen years old; and am anxious to learn dressmaking. I can now do all kinds of plain sewing neatly and rapidly

Hoping you will be willing to accept my services,

I am yours truly,

ADA NELSON.

LETTERS OF RECOMMENDATION.

Letters of recommendation should be given cautiously, as by them one is made to a certain extent responsible for the character and conduct of another person.

They should be given only when the writer is thoroughly acquainted with the habits and capacity of the party seeking the recommendation. Tell the exact truth in such letters, as, by any attempt to gloss over faults, a person injures his own character for truthfulness, and is liable to do a great injury to the person to whom the letter is presented.

A lavish and indiscriminate use of such letters will render them totally valueless, and seriously injure one's reputation as a business man; and may render him legally liable if he knowingly gives a recommendation to a person who is not entitled to it.

When obliged to refuse a request for recommendation, do so with as little offence as possible, stating whatever may be said justly in favor of the person.

Recommending a Clerk.

MILWAUKEE, WIS., Aug. 2, 1882.

MR. JAMES KINGSLEY:

Dear Sir, — The bearer, Mr. Harvey Smith, has served our firm in the capacity of entry clerk, with integrity and fidelity, during the past three years; but, desiring to locate in your city, he has left our employ.

His behavior while with us was above reproach; he was honest, sober, and diligent, and we have no doubt he would be the same with you.

Should you conclude to employ him, we trust he will give satisfaction.

Yours, NORTON, MCKNIGHT & HAWLEY.

Recommending a Bookkeeper.

CONCORD, MASS., Sept. 11, 1882.

KNIGHT, FISHER & CO.:

Gentlemen, — The bearer, Mr. T. W. Oker, being about to leave our employ, it gives us great pleasure to state that, during the four years he has been in our counting-room, he has faithfully attended to all his duties, thereby proving himself thoroughly reliable and trustworthy.

He is a rapid penman and a correct accountant, and we desire for him every success.

H. H. HAM & CO.

Recommending a Housekeeper.

SOUTH HADLEY, May 10, 1882.

MRS. H. D. STREET:

Dear Madam, — In reply to your favor of the 4th, making inquiries in regard to my former housekeeper, Mrs. Juliet S. Newton, I take great pleasure in certifying to her worth.

She resided in my family for nearly six years, and I found her trustworthy, economical, cleanly, industrious, gentle with the children, and a valuable housekeeper in every respect.

BYRON ALDRICH.

Recommending a Governess.

MARION, O., Aug. 11, 1882.

MR. JOSEPH CARTER:

My dear Sir, — Miss Ella Chase has been in my employ as governess during the past two years, and has given perfect satisfaction. She is a thorough English, Latin, and French scholar, and a fine musician.

Yours very truly,

MRS. ANNE FAIRCHILD.

Recommending a Laborer.

FREEPORT, ILL., Jan. 9, 1882.

MR. D. J. SPOFFORD:

Dear Sir, — In answer to your inquiries, I would say that Eugene Gates is competent to discharge such duties as you require.

He has lived upon a farm all his life, and is thoroughly acquainted with farm-work of every description, being accustomed to the care of horses, cows, and other stock. I should have no hesitation in placing him in charge of a farm.

Yours very truly,

E. C. BOLTON.

Recommending a Cook.

FULTON, IOWA, Oct. 7, 1882.

MRS. N. D. REYNOLDS:

Dear Madam, — In answer to your letter of Saturday, would say that Emily Small has been in my kitchen during the past two years, and I have found her capable, willing, and honest.

MRS. JOSEPH HALL.

Declining to recommend a Clerk.

St. Louis, April 31, 1882.

Henry Gaylord, Esq :

Sir, — I regret that I cannot with truthfulness give you the testimonial you request of me, and am surprised that you should ask it.

Although you may possess some ability, you are aware of the dishonesty which caused your discharge from our service; and it would be doing a gross injustice to recommend you to another employer.

A frank confession and earnest desire to reform would be your best recommendation.

Armstrong & Hawley.

A First Order.

No. 259 State St., Scranton, Pa., Dec. 4, 1882.

Messrs. Thompson & Gaylord,
Pittsburg, Pa.:

Gentlemen, — Having recently started in business under the firm name of Ayers & Cummings, we send you enclosed our first order.

As our capital is limited, it is our intention to conduct business as nearly as possible upon a cash basis. As you are aware that a majority of our dealers require time for payment, we shall be under the necessity of requesting short credit on some proportion of our orders.

Would refer you, as to character and business capacity, to Messrs. Hitchcock & Fairbanks, No. 192 Broadway, New York, with whom one of us has been connected during the past nine years; also to Messrs. Bretton & Snow, No. 42 Walnut Street, Wilmington, Del., who is acquainted with both of us.

Trusting you will fill our order at your earliest convenience, we remain,

Yours respectfully,

Ayers & Cummings.

Answer to Foregoing.

THOMPSON & GAYLORD,
DEALERS IN ALL KINDS OF
MILLINERY AND FANCY GOODS.
LADIES' DRESS GOODS A SPECIALTY.

No. 453 Munroe St., Pittsburg, Pa., Dec. 6, 1882.

Messrs. Ayers & Cummings,
Scranton, Pa.:

Gentlemen, — Your favor of the 6th inst. duly received and contents noted.

We are pleased to state that the result of our inquries in regard to your firm have been most satisfactory.

Your order has been filled and goods forwarded by Bothwick's Express, a bill of parcels being sent by mail.

One half the gross amount of the bill we shall expect cash for, on which we will allow you 4% discount. For the remainder we will give you four months' time.

With best wishes for your success, we are,

Yours,

Thompson & Gaylord.

Advice of Shipment.

No. 390 Broadway, New York, Oct. 15, 1882.

Messrs. Gardner & Houston,
New Orleans:

Gentlemen, — Agreeable to your order of the 9th inst., we have this day shipped you per S. S. "Pride of the West," Davenport, master, 100 cases silk and 150 cases woollen goods, as per invoice, of which we send you a duplicate B/L by mail. Trusting the goods will reach you safely and prove satisfactory,

We remain,

Yours,

Johnson & Carew.

Order from an Established House.

No. 360 Main St., Detroit, Mich., Feb. 9, 1882.

Messrs. Bailey & Co.,
Cleveland, O.:

Gentlemen, — As your goods have been recommended to us, we would like to give them a trial, and for that purpose order

5 doz. pairs Ladies' Cotton Hose	@ 50c.,	$30
10 " " Gent's " "	@ 25c.,	30
		$60

Please forward at once, and, should they prove salable in this market, we may order more extensively. Enclosed find draft on our Cleveland bankers, Davidson & Smith

Yours, etc.,

Chase & Powers.

Retail Dealer to Customer.

Granby, Canada, May 9, 1882.

Mr. Henry Snow:

Dear Sir, — Your bill for goods supplied last winter has now been due upwards of four months; and I have written you several times to solicit payment, but have not been so fortunate as to receive an answer.

I have a large sum to make up in the course of the month, and will draw on you at ten days. Trusting you will be prepared for the same, I remain

Yours very truly,

Hiram Smith.

Inquiring as to Responsibility.

No. 730 High St., Troy, N. Y., May 8, 1882.

Mr. James Alden,
Charleston, S. C.:

Dear Sir, — Mr. Walter Crosby, of Chicago, Ill., has done us the honor of ordering a bill of goods amounting to something over $800, and, being a stranger to us, has given your name as a reference and as one who might guarantee our sales to him.

We are particularly desirious of extending our business in the West, and would accord to Mr. Crosby every facility, provided we were assured of his responsibility; and would be pleased to have you communicate to us your confidential opinion as to his standing and means, and whether you will guarantee us in selling him,

And oblige yours,

Johnson & DeWitt.

Answer to Foregoing.

No. 320 Dwight St., Charleston, S. C., May 10, 1882.

Messrs. Johnson & DeWitt,
Troy, N. Y.:

Gentlemen, — In response to your favor of the 6th, in which you state that my friend, Mr. Walter Crosby, has referred you to me as guarantor for your sales to him, I beg to say that, while I would not hesitate to give credit to Mr. Crosby for the amount of goods he has ordered from you, it is contrary to my practice to guarantee the bills of any one.

I have known Mr. Crosby for a number of years, and believe him to be a man of strict integrity. Of the extent of his resources I am not aware, but think them ample for the business he carries on at present. With those with whom he has previously dealt in this city my friend bears a good record; and I doubt not his reliability has improved through the experience he has gained in building up his reputation and business.

Yours respectfully,

James Alden.

P. S. — It would be of no direct benefit to me to secure you in your dealings with him, but I will do so, if you wish, for an ordinary consideration, say 1%.

An Account opened.

No. 730 High St., Troy, N. Y., May 15, 1882.

Mr. Walter Crosby,
Chicago, Ill.:

Dear Sir, — Your friend, Mr. Alden, has declined to guarantee our sales to you without a consideration of 1%. This is not satisfactory, but he has so highly recommended you that we have concluded to deviate from our usual custom of requiring such from strangers, and have duly filled your order, amounting to eight hundred and sixty dollars ($860.00).

Please find enclosed the bill of parcels, forwarded by Adams's Express this day, and two notes of four hundred and thirty dollars ($430.00) each, drawn in our favor, at two and three months respectively, which be kind enough to accept, payable at the banking-house of Lowe & Jenson. with whom we maintain a collection account, and oblige,

Yours,

Johnson & DeWitt.

Order for Insurance on Shipment.

No. 196 Worcester St., New Orleans, Aug. 13, 1882.

Messrs. Bradley & Co.,
Philadelphia, Pa.:

Gentlemen, — You will please effect insurance for my account on the two following parcels: —

1st. $3,000 on nine hundred barrels of St. Louis flour, on board the bark "Ocean King," Jackson, master, from this port to Portland, Me., to sail this day. Let the premium be the lowest possible rate, as the vessel is perfectly seaworthy and under an able commander.

2d. $2,500 on four hundred bales of Sea Island cotton, on board clipper "Traveller," Forbs, master, from Baltimore, Md., to Providence, R. I., expected to sail the 18th of the present month. In this I beg to limit you to one half of one per cent.

Trusting you will exert your best endeavors for our advantage, and draw upon me as usual for the amount of the premium,

I remain very truly yours,

R. C. Hitchcock.

Letter of Complaint for Imperfect Goods.

No. 570 Main St., Savannah, Ga., Aug. 24, 1882.

Mr. George Carter,
Philadelphia, Pa.:

Dear Sir, — For the first time in our long business connection with your house, I am obliged to complain of the goods forwarded me by the last steamer.

They were so imperfectly packed that some of the pictures were seriously injured by rubbing together, while the frames were inferior to the last received at the same price.

I should prefer to return the goods, and will do so, unless you wish to deduct 25 per cent, at which price I will keep them to save expense of transportation.

I remain, yours truly,

E. J. Merrill.

Notice of an Agent's Visit.

[Printed heading.]

Oct. 31, 1882.

Messrs. Moore & Co.,
Baltimore, Md.:

Gentlemen, — Our agent, Mr. Jackson, is travelling in your direction, and expects to reach your city about the 13th of the coming month.

We should be pleased if you would defer placing your orders for spring goods until you examine his samples. With the expectation of increased orders from you,

We remain yours, etc.,

B. R. Whitmore & Co.

Notice of the Arrival of New Goods.

[Printed heading.]

Nov. 20, 1882.

Messrs. Sharpe & Phelps,
Trenton, N. J.:

Gentlemen, — Have this day received, per steamer "Mermaid," sample patterns of albums, and shall be pleased to have you examine the same prior to an exhibition of them to the trade.

Will you be good enough to inform me as to when it will be most convenient for you to look at them?

Trusting you will name the earliest possible moment,

I remain, yours truly,

Thomas Kelly.

Notice of giving Power of Attorney.

No. 376 Bridge St., Frankfort, June 19, 1882.

Messrs. Brainard & Corey,
Buffalo:

Dear Sirs, — Having determined upon a visit to Europe and a probable absence of some months, I beg to inform you that my business will be carried on as usual by my friend and clerk, Mr. Fred. Miller, to whom I have given a power of attorney, authorizing him, during my absence, to draw checks, receipt bills, and do all other acts, the same as if they were done by me in my own person.

Yours,

W. S. Hatfield.

Letter to the Public through the Means of Circulars distributed by Mail or otherwise, or inserted as an Advertisement in the Newspapers.

To our Patrons and the Public in General:

Messrs. Bancroft & Co. would most respectfully announce that they have received this day, by freight overland from the East, one hundred cases of men's and boys' clothing, all of which are fresh goods, and of the latest fall styles.

These, together with our already large stock, we are confident will meet all demands and requirements in our line. *Latest and most popular goods, quick sales and small profits, are our mottoes.*

Thanking the public for its liberal support in the past, and anticipating through our untiring efforts an increased trade in the future, we remain as ever

The public's most obedient and devoted servants,

C. Bancroft & Co,
41 Sacramento St., San Francisco.

Advertising, similar to the foregoing and in numerous other ways, is generally made use of at the present day, especially by enterprising concerns; and it is not unusual for our large firms to pay out hundreds of dollars for one insertion of an advertisement in some newspaper having a large circulation.

The expense of some of our leading houses for advertising foots up thousands and even hundreds of thousands of dollars in the course of a year.

ADVICE AS TO ADVERTISING.

At the present day, advertising has become a necessary feature in almost every business, and live men are quick to take advantage of any legitimate means to call public attention to their business. Thus every parcel that leaves their place of business bears their "ad.," if it can be placed on it.

Your wife's dress comes from the dressmaker's wrapped in paper bearing the imprint of "Miss Nellie Brennan, Fashionable Dressmaker, No. 574 Fifth Avenue, New York."

Of course, persons in advertising must be guided by their means, taking care to use their best judgment as to the most profitable way suggested.

A good plan is to devote a certain safe per cent of your income to advertising. It is well, of course, to consider just what class of people you desire to reach, and what method or paper is the best calculated to reach them.

Dressmaker's General Circular on Opening an Establishment.

MISS HATTIE BROOKS

Begs to announce to her Friends and the Public in general that she has recently opened

DRESS AND CLOAK MAKING ROOMS

AT NO. 750 LA SALLE STREET,

where she would be pleased to see all desiring Work in her line, as she is confident she can give perfect satisfaction, having for Six Years had charge of the Dressmaking Department of Messrs. Twist & Stitch.

Milliner's Circular.

1882. SPRING. 1882.

MILLINERY OPENING.

We shall be pleased to see you at our Opening of

Paris Bonnets, Hats, and Novelties,

ON

WEDNESDAY AND THURSDAY,

March 29th and 30th.

Mrs. J. J. GRACE - - - - 31 Temple Place,

BUFFALO, N. Y.

Circulars may be delivered by hand, or sent through the mail, or inserted as advertisements in any or all of the newspapers of the place; or, if the party desires to advertise freely, all of these and other means may be used which will readily be suggested.

As before stated, a person just starting or desirous of increasing his business should use his most careful judgment as to the easiest and most profitable method of advertising, as it depends a great deal on circumstances.

A good way, if you wish to advertise in the newspapers, is to examine carefully some paper having a large number of advertisers, and take advantage of the best appearing "ads." in your line of business, or be guided by some more experienced friend.

It is also a good idea to have a scrap-book, say a small blank-book, and paste therein your advertisements or circulars as issued, with cost and duration of each. You can then insert the number of responses or probable profits of each, and also see which is probably the best means of advertising for your business. By having such a record, you will derive some benefit from your past experience, and it is, as readily seen, a guide to the future.

Keeping Accounts. — It is necessary for the success of men in business that they have or acquire a practical knowledge of book-keeping, so as not to be at the mercy of others.

In another part of this work is the Bookkeeping Department, which is excellent, as far as it goes, as a foundation; but no aspiring man will rest satisfied with the knowledge contained therein. A thousand other means to increase the success and profits of business suggest themselves to the practical accountant. The above and other safeguards are not generally known or made use of, or are neglected, mainly through the want of this practical knowledge on the part of employers. The writer of this is a business man, and knows whereof he speaks.

When it is considered that but about fifteen per cent of those who start in business succeed, and that the majority of failures are due to neglect of keeping proper accounts, it is apparent that a more general knowledge of this foundation of business, *the art of keeping its accounts properly*, seems absolutely necessary; and no better advice can be given to those who wish to rise in the world than to labor to acquire this power.

Single entry may do for a small or ordinary business, — that is, with all the necessary auxiliary books; but it only records the necessary transactions once, while double entry gives a complete record of everything that enters into the merchant's transactions. How often do we see men in an ordinary or fairly large business keeping little if any account, or else in a slipshod or unsatisfactory way! They have the care of their accounts and their business, and may be all at sea, or have a wrong idea as to their condition. Larger firms might not be better off were it not for the fact that the size of their business compels them to engage persons fairly competent to keep their accounts. Considering the amount of confidence and trust placed in the clerk's hands, it speaks volumes for the honesty of human nature, and for the method and training of those who educate themselves to discharge such trusts. It seems that the knowledge acquired by those keeping accounts brings with it an increased pride in their calling, — a desire, above all, to have everything correct, and an increasing perception of the necessity of correctness, punctuality, and integrity withal. It always *pays* to keep the *business record* properly, no matter how small the business; and, if the owner is not competent or has not time, it is his duty, to himself, to his family, to his creditors, and to all, to have his books properly kept: and no man who has had a proper person in charge of his accounts will dispense with the services of an accountant, unless he acquires such knowledge, and has time to attend properly to it himself.

STUDYING BOOK-KEEPING. — The simpler the book or instruction on book-keeping that covers the ground, the better, as the simplest and plainest way to keep accounts is best. The book-keeping taught in the public schools is of great benefit, though there is one great drawback, — the scholars are generally too young, and have not the education or knowledge requisite to master the subject. The student who wishes to acquire this branch will find that a fair general education is necessary, though a man with only a very ordinary education can readily acquire the knowledge of keeping the accounts of an ordinary business, and, if his business increases to large proportions, he can call in the aid of those competent, or better still, as business men generally do, increase his store of knowledge; at all events, he should labor towards that end. SCHOOLS for BUSINESS training are generally fair, though as a rule the instruction given is not sufficiently practical; they seem to labor as much for show as for benefit. The person who enters may see departments for banking, insurance, interest, discount, etc., and their books are generally gotten up after this manner of display. The student may labor to master these branches too quickly; but the scholar, no matter where he studies or learns, should endeavor to acquire the rudiments properly, to lay the foundation solidly, in this as in all other things. By doing so, the rest will come more easily and with more force afterwards. Where there is a will there is a way; and, if a person wishes or is obliged to instruct himself, by proper application and study he may master this as well as any other branch of education.

LETTERS OF CREDIT.

Letters of credit are of great convenience, and necessary in travelling, especially in foreign countries, as they prevent the danger of loss by carrying large sums of money.

The signature of the party in whose favor the order is drawn is generally upon the margin, and, for still greater certainty, a photograph of the person is sometimes employed, especially where large sums of money are involved. The following is an example: —

No. 938 STATE STREET, SAN FRANCISCO, Aug. 23, 1882

MESSRS. HALL & CHURCH,
Albany, N. Y.:

Gentlemen, — We beg to introduce to you the bearer, Mr. George Tucker, of this city. He intends to purchase goods in your city, and you will please furnish to him any funds he may desire, not exceeding eight thousand dollars ($8,000), and charge to our account, taking either his receipt or draft on us as may be most agreeable to you. You will find Mr. Tucker's signature on the margin.

Yours,
D. K. LAWRENCE & CO.

A letter of credit may be for money, as the above, or may take the form of an order for goods, to be delivered to the bearer and charged to the writer, thus:—

SKOWHEGAN, March 31, 1882.

MR. JOSHUA DICKERSON:

Dear Sir, — Please deliver to bearer, Mr. Levi Day, two barrels of apple-sauce, five bundles of shingles, and two bushels of cranberries, and charge the same to

MEHITABLE PERKINS.

TELEGRAPHIC MESSAGES.

When sending messages by telegraph, endeavor to use the fewest and most simple words which will convey clearly the exact meaning that you desire; but never cut short your message to save a little extra expense, when by so doing you leave the sense obscure or incomplete.

Sign your name in full, and add the street and number of the address to which you wish the answer sent, which may be done without extra charge. It is a good plan to always have the operator read the message aloud to you, in order to be certain he makes no mistake.

LOWELL, MASS., June 1, 1882.

MR. GEORGE REYNOLDS,
No. 137 Main Street, Concord, N. H.:

I am to be married Wednesday morning at ten. Will you act as best man? Answer by wire.

GEO. B. BARNES.

INSURANCE.

It is a duty that every man owes himself, his family, and his creditors to secure proper protection against loss, when the same is possible by honorable means. No man can carry on business without subjecting himself to a liability to loss, and no man can tell when disaster may overtake him; therefore it would be criminal negligence on any man's part if he failed to avail himself of every legitimate protection which the age affords: and one of the most convenient forms of protection is the insurance company, who, for a consideration, will indemnify you in case of loss. The man who fails to insure and keep insured is "penny wise and pound foolish," and his creditors, if he has any, will give him little credit for business judgment, and will therefore be much less inclined to give him credit for their wares. The honest as well as the shrewd man will endeavor to have his stock fairly well covered by insurance.

It is becoming a custom among the business men of the present day to insure their lives for the benefit of their families, or their partners, their creditors, or themselves as in the case of endowment policies; and, when a man can afford it, none will be found who will gainsay it as a prudential measure.

BUSINESS ADVICE.

HALIFAX, N. S., Oct. 5, 1882.

L. S. PIERCE:

Dear Sir, — Your letter of the 1st inst. has been duly received, wherein you are pleased to solicit my advice touching your intention of establishing yourself in business, and to express a desire for ascertaining the best means whereby to insure respectability and success in a mercantile line of life.

I am not aware of the extent of the means which you intend to invest permanently, but I presume that you have calculated the chances and risks of a competition from other sources, and have therefore set aside a sufficient sum to sustain your enterprise until a fair trial can be had of the locality in which you seek to establish yourself. I presume also you have taken your age into consideration; for a man may undertake to establish himself in business too early in life, as then he may lack both the knowledge and experience for successful competition. However, I would not advise you to defer your project to an over-remote period, for long waiting may perchance rob you of that zeal and courage indispensable for business purposes. Generally, the exuberance of youth tempts toward visionary speculation; apathy in middle age closes the eyes to brilliant opportunities; while an excess of caution very frequently induces unexpected ruin.

Your first ambition to prove a competent trader should be the acquisition of knowledge, and particularly of information appertaining to your business. You will find yourself thrown in contact with men of various dispositions and tendencies: some may be ignorant, yet crafty; others intelligent and still disingenuous. To combat both of these classes requires a deal of worldly wisdom; nevertheless this wisdom is readily acquired through studious observation of men and of books. Where a dealer finds you thoroughly conversant with the history of the articles in which you trade, it induces him to confide in your judgment. Conversational ability is an appropriate accessory to successful traffic, as you can attract through its means friends, who may prove reliable patrons; and, in addition to enabling you to sustain a mixed conversation, general learning is an absolute requirement for a man of commerce.

Endeavor to acquire a correct epistolary style, as those with whom you correspond are tempted to judge of your abilities through the manner and expression of your letter-writing.

Before establishing yourself, you should estimate the extent of business which can be done with a portion of your capital, and make close calculations as to the probable cost of your personal expenses and that of maintaining your establishment. You should be always cautious to keep a reserve fund, in order to anticipate the annoyance of bad debts, or the chance occurrence of contingencies of such a nature as cannot be instantaneously provided against. With this reserve I would advise you to open a bank account and maintain the strictest faith with your banker, so that, when you desire accommodation, you can enjoy a preference over those who keep vacillating or doubtful accounts.

Do not enter into copartnership unless upon most advantageous terms, as it is more agreeable to labor and accumulate through your own exertions; still, should an opportunity offer to consolidate with some older and well-established house, generally avail yourself of it, for it is wiser to be the junior of a highly respectable firm than to be the head of one struggling to obtain a foothold.

Let the arrangement of your books precede all other operations, and, if convenient, make all original entries yourself, while supervising your accounts daily. See that all your transactions are correctly noted, and your records faithfully kept, as many firms are entirely ruined through intrusting too much to the fidelity of clerks and bookkeepers. Bear in mind that your books are a legal record of your business life, and, in the event of death, constitute the most reliable schedule of your personal estate.

During business hours attend to nothing but business. Cultivate the acquaintance and friendship of men of your own habits, and of those particularly engaged in a branch of trade similar to your own, as, by so doing, you not only extend confidence in your own integrity, but glean a mass of valuable information upon trade topics. But neither deal nor associate with persons of equivocal character; on the contrary, your credit will augment proportionately to the extent of your transactions with reputable houses, as their indorsement coming to your banker's notice will convey to him a favorable impression as to your business relations.

Without identifying yourself with politics, watch their course with circumspection, as the various changes in national affairs may have a tendency to affect business. Study the history of current events; make careful comparisons of the fluctuations in price, in demand, and in supply, from month to month and from year to year, in order that you may guide your own operations by the lessons these facts impart.

Be prompt in responding to all communications, and never suffer a letter to remain without an answer: by attention and condescension you will succeed in securing the esteem of your correspondents, and gain from them a preference in receiving commissions.

Never fail to meet a business engagement, however irksome it may be at the moment. Do not descend to prevarication or procrastination, or seek to work out of an obligation, even if you have a chance so to do. Should the word of a man prove worthless, his bond will be looked upon as equally valueless. Prefer as much as possible dealing for cash, or upon the shortest credit, and by adopting this rule you will avoid complications which may prove ruinous.

Undertake no business without mature reflection: through accident, a rash and precipitate act may turn out profitable; nevertheless, as a general thing, deliberation and the avoidance of risks betoken a healthy business character. Confine your capital closely to the business you have established; avoid speculations in anything, however tempting, if foreign to your line of trade; and, should you have any surplus above the requirements of your establishment, invest it only in those securities which your banker would be willing to accept as collaterals to a loan, should you desire one.

Lead a regular and domestic life; avoid ostentatious display in costume and manner of living; choose your associates discreetly, and prefer the society of men better than yourself *morally* at least. A vain and extravagant course of life, even if you have the means to sustain it, impairs your credit and standing as a mercantile man, while dissipation of any kind will assuredly deprive you of both credit and reputation.

Should you prove successful, be not over-elated; and treat your debtors with leniency and compassion, for bear in mind that the storm of a day's duration may sweep away the labor of years.

Avoid litigation as much as possible; study for yourself the general theory of law applying to commerce. Apart from saving moneys expended for costs, this species of knowledge confers upon you a self-reliance and confidence; while its possession secures for you the respect of your business neighbors.

Be affable, polite, and obliging to everybody; avoid discussion, anger, and pettishness; interfere with no disputes that are the creation of others; decline acceptance of political or conspicuous social positions, and your modesty will gain you profitable friends instead of envious detractors.

Should you find yourself in embarrassment, or threatened with adverse circumstances, seek out some judicious adviser, one capable of giving counsel, and lay before him in ample detail the facts of your case. Listen to his suggestions, ponder upon them, and, should they appear fair and honorable, act upon them. But never resort to desperate resources to extricate yourself, with a possibility of sinking deeper in the mire. It is better to go at once into bankruptcy than to endure the agony of a prolonged series of disappointments. Should the counsel of your first adviser fail to satisfy your anticipations, seek the views of a second; then refrain from going further, but act upon your own judgment as enlightened by the views two reliable friends have expressed.

Remember that the golden rule of commercial life is probity. Act, therefore, honestly, uprightly, and conscientiously in all matters of trade; never misrepresent, falsify, or deceive; have one rule of moral life, and never swerve from it, whatever may be the acts or opinions of other men. I trust that you will be eminently successful; but, should the result prove otherwise, I hope that your conduct will have been such as to have won the esteem and sympathy of all, and of Yours, etc.

SELLING ON TIME.

Credit is a necessary part of business, as, if goods are sold for cash, they are not generally paid for until delivery. It is advisable to be as careful in giving as in asking credit. Do not take extra risks. If you are satisfied you had better not trust the party seeking credit, do not. Learn to say no, if you have not already. Do not in this case be influenced by the buyer's wish to buy, or your own desire to sell goods. In dealing with a person of whom you think it advisable to know more before trusting or furnishing with goods, require of him his references, which should be cheerfully furnished; if not, it is all the more necessary to require them.

Business men generally refer to their bank, and to the parties with whom they trade or are acquainted. The seller should, as soon as possible, take pains to notify such references, and then, after hearing from them, use his best judgment as to how much credit, if any, the buyer is entitled to, and the length of time to give.

MERCANTILE AGENCIES are concerns that endeavor to keep, as near as possible, a correct statement of the standing of business men generally. Books are furnished to their subscribers, in which the names of the firms that they have knowledge of are entered according to their supposed integrity and worth; and, to any one inquiring, they will, for a consideration, endeavor to supply all necessary information.

This information may be considered a guide to a certain extent, but not to be implicitly relied on, as their inquirer may be venal, or may not have necessary judgment. While it is the aim of these agencies to have a correct account, sometimes this may involve considerable trouble and expense. As there are of course several thousand names on their books, they may not every year endeavor to find out the different changes that occur among them; especially might this be true of the smaller firms on their books.

BOARDS OF TRADE are associations formed by the leading merchants, especially of large cities, for their mutual protection and benefit.

There are also boards of trade composed of associations of leading members of any particular branch of business throughout the country, as the *Stationers' Board of Trade*. These aim to keep an account of the standing of its members, and of the trade generally. On account of their means of information, their knowledge can be relied on to a great extent. Perhaps the better way is, as at first stated, to get direct references, and thus get at the groundwork of the applicant's reputation and worth.

A BANK account should be kept by all persons doing business, even if the business is small and but little money to deposit. It saves a deal of bother and annoyance, has the appearance of business, and saves the necessity of taking care of or carrying much money.

Banks are generally willing to take a very small deposit on account to commence with, rightly judging that the business will generally increase, and that the depositor may become a valuable one.

To open a bank account, if you do not know or are not decided as to which bank you wish to deposit with, inquire among your business acquaintances, who will advise you, after taking into consideration your business, capital, etc. The nearer the bank to your place of business the better.

After deciding to open a bank account, you can go direct to the officers of the bank, taking with you, if convenient, a friend who is acquainted with the bank authorities, who, in accepting your account, will give you all necessary information. You, with your partners authorized to sign the firm name, if any, will be required to subscribe your names and business in the signature book. You may also be required to give the name of some person or firm as reference.

This *signature book* is for reference, and for your and the bank's greater security, as they thus become acquainted with your signature.

The bank charges nothing for transacting this part of your business; they receive in return the use of your money. It is advisable to bear this in mind, and to endeavor to keep as fair a balance as your means will allow. You will be required, in all your transactions with or through the bank, to be straightforward and accurate; if not, you will very likely be invited to withdraw your account, which will have a tendency to injure your reputation. It is better to have the money in bank to meet your note or obligation at least one day before it becomes due, as the obligation may be charged through the clearing-house a day before, or early on the day, it becomes due.

Three days of grace are generally allowed on notes, drafts, etc., that are made payable at a fixed time. In paying, these can be availed of, as, in interest and discount, they are charged for.

The CLEARING-HOUSE is an institution established by an association of banks generally in large cities, to facilitate the transaction of their business.

The commercial or business paper, such as notes, drafts, etc., that you owe, is deposited, by those receiving, in their respective banks for collection or discount, and, when due, is presented by said bank or by its representative, or the bank receiving it in the city wherein you reside, to your bank for payment. For greater convenience between the banks themselves, all this commercial paper is audited and settled each day at the clearing-house.

NOTES. — In giving notes, they can and should be made payable at the bank, and it is your duty to see that there are sufficient funds to meet them as they become due. The fewer notes given the better; and a note should not be given unless you are certain you will be prepared to meet it, as, if not paid, it is protested, and the protest is recorded, which will decidedly injure your credit. (For further information, see legal department of this book.)

OPEN ACCOUNTS are better for the buyer than notes given, as you may, if necessary, be allowed extra time; but you should not buy beyond your ability to pay, so that you may be obliged to ask or avail yourself of this privilege.

CHECKS can be given for all the larger bills, or all the bills you wish to pay in this manner. Never give a check when you have not enough money in bank to meet it, nor date it ahead, intending to have the money when due.

The *bill-book* in bookkeeping explains how to keep your bills, so that you can keep your accounts in this respect correct.

A MONTHLY DIARY should be kept; that is, all your bills and accounts payable and receivable, for each month in advance, should be put together, a page or more for each month, and added up. You can then see what you will have to pay, what you may rely on receiving; and, in connection with the probable receipts from your business, you can then better tell in what position as regards money matters you will be. (See cash tickler in bookkeeping.)

LOANS AND DISCOUNTS.

A bank depositor receives credit on his account, not only for the *cash* he deposits, but also for the *representatives* of cash, such as checks, notes, etc., which are left with the bank for *collection;* and the profit arising from this class of transactions forms one of the bank's main sources of revenue; and the bank, therefore, affords all the conveniences possible in order to secure this business.

PROMISSORY notes, drafts, money-orders (which are simply inland bills of exchange), are styled *bills* in bank language.

BUSINESS PAPER is that class of mercantile bills which are negotiable and payable at some bank.

There is another class of mercantile bills, which are made payable at the holder's place of business, and it is not considered as being strictly negotiable.

When a man needs money he will, of course, resort to his *bills receivable*, and these he may realize on by offering them for *discount* to his bank, for banks were originally established for this very purpose; that is, for the purpose of *lending their capital.* In this respect, at least, have nothing to do with brokers. Where a depositor offers *good paper* to his bank for discount, he confers a favor on it. As the demand for money often exceeds the supply at hand, the skill of the banker is put to severe strains in order to so use available cash to satisfy, as nearly as may be, the demands of their patrons.

In discounting a note, the bank will consider the *standing* of the parties thereto. In case of a refusal, a depositor should not feel aggrieved because he considered the note perfectly good: for the bank's sources of information are greater and more varied than their depositor's, and the refusal may inure to the depositor's benefit; for if the bank accepted the note, and parties liable on the same failed to take care of it when it fell due, the depositor might find himself in a disagreeable situation by having to pay a note without the means to do it at hand.

The capital of banks, as well as their surplus accumulations over dividends, should be in good promissory notes, purchased from dealers at a discount: but *money deposited* with them by customers is not generally permanently invested, because of the liability of its withdrawal at a day's notice; hence, in order to make this class of funds productive of profit, they are loaned on *demand notes*, secured by hypothecation of such securities as can be converted into cash when needed; and this transaction is known as a *call loan*, while the first are temporary INVESTMENTS.

A CALL LOAN is the better method of borrowing from a bank, as the cashier is allowed the option of loaning deposited money on marketable securities; and then again, although payable on demand, the demand may not be made for a year, which, by the way, in computing interest, is generally reckoned as 360 *days.*

Interest on a call loan is not payable in advance, while the contrary is the case with a discounted note.

A business man needs to invest his surplus capital in government bonds, or other equally reliable and marketable security, if he would avail himself of the call-loan system. The advantages of the system are, that the rate of interest is *lower*, and it is *not* required in advance; the money can be raised at a *moment's* notice; and an account with, or a fair average in, the bank, is *not* necessary to the procuring of a loan. Another thing, the making of a call loan is left with the *cashier*, while the discount of paper is reserved for the general management of the bank assembled as a *board of direction;* and therefore it is only at certain intervals, *usually once a week*, that notes for discount can be accepted.

When a merchant has a *note for discount*, he notifies the *discount clerk* of the same, with all the particulars in writing, who in turn brings it to the proper authorities by means of a book kept for the purpose and usually called an *offering-book*, wherein the facts connected with the note are stated, and also the amount *already* under discount for borrower, as well as the *average balance* of his deposits for the previous months; and upon these, in a great measure, depend the acceptance of the paper.

Never offer to a bank, for discount, any other than your legitimate business paper; for, if you hold any other kind which is equally good, it will be readily accepted as *collateral security* for your own note for a less amount, and payable within a reasonable time.

Accommodation Paper.—Always avoid dealing, or the suspicion of dealing, in accommodation paper. No man who desires to maintain his credit will do so. It is an accepted sign of weakness, and rarely escapes becoming known to the business community.

INDUSTRY AND INTEGRITY.

Advice.—Success secures the approbation of the world; for, as the wise man says, "Men will praise thee when thou doest well for thyself."

"There is nothing possible to man which industry and integrity will not accomplish. The poor boy of yesterday — so poor that a shilling was a miracle in his vision; houseless and breadless; compelled to wander on foot from village to village, with his bundle on his back, in order to procure labor and the means of subsistence — has become the talented young man of to-day by the power of his good right arm, and the potent influence of his pure principles, firmly and perpetually maintained. When poverty, and what the world calls disgrace, stared him in the face, he shuddered not, but pressed onward, and exulted in high and honorable exertions in the midst of accumulating disasters and calamities. Let the young man be cherished; for he honors his country, and dignifies his race. Wealth! — what cares he for that, as long as his heart is pure and his walk upright? He knows, and his country knows, and his country tells, that the little finger of an honest and upright young man is worth more than the whole body of an effeminate and dishonest rich man. These are the men who make the country, — who bring to it whatever of iron sinew and unfailing spirit it possesses or desires."

"Instead of saying that man is the creature of circumstance, it would be nearer the mark to say that man is the architect of circumstance. It is character which builds an existence out of circumstance. Our strength is measured by our plastic power. From the same materials one man builds palaces, another hovels; one warehouses, another villas. Bricks and mortar are mortar and bricks, until the architect can make them something else. Thus it is that in the same family, in the same circumstances, one man rears a stately edifice, while his brother, vacillating and incompetent, lives forever amid ruins. The block of granite, which was an obstacle on the pathway of the weak, becomes a stepping-stone on the pathway of the strong."

MORAL COURAGE.

Have the courage to discharge a debt while you have the money in your pocket.

Have the courage to do without that which you do not need, however much you may admire it.

Have the courage to speak your mind when you should do so, and to hold your tongue when it is better you should be silent.

Have the courage to speak to a poor friend in a threadbare coat, even in the street, and when a rich one is nigh. The effort is less than many take it to be, and the act is worthy of a king.

Have the courage to set down every penny you spend, and add it up weekly.

Have the courage to admit that you have been in the wrong, and you will remove the fact from the mind of others, putting a desirable impression in the place of an unfavorable one.

Have the courage to adhere to a first resolution when you cannot change it for a better, and to abandon it at the eleventh hour upon conviction.

Have the courage to face a difficulty. Difficulties, like thieves, often disappear at a glance.

Have the courage to leave a convivial party at a proper hour for so doing, however great the sacrifice; and to stay away from one upon the slightest grounds for objection, however great the temptation to go.

Have the courage to dance if you wish to do so; and to decline dancing if you dislike the performance, or cannot accomplish it to your satisfaction.

Have the courage to shut your eyes on the prospect of large profits, and to be content with small ones.

Have the courage to tell a man why you will not lend him your money; he will respect you more than if you tell him you can't.

Have the courage to cut the most agreeable acquaintance you possess, when he convinces you he lacks principle. "A friend should bear with a friend's infirmities" — not his vices.

Have the courage to wear your old garments till you can afford to pay for new ones.

Have the courage to pass the bottle without filling your glass, when you have reasons for so doing, and to laugh at those who urge you to the contrary.

Have the courage to review your own conduct; to condemn it where you detect faults; to amend it to the best of your ability; to make good resolves for your future guidance, and to keep them.

Have the courage to prefer propriety to fashion: one is but the abuse of the other.

Have the courage to confess ignorance whenever, or with regard to whatever subject, you really are uninformed. And remember that avoiding evil is but one half of our work: we must also do good. One act of beneficence, one act of real usefulness, is worth all the abstract sentiment in the world; and that humanity is despicable which can be contented to pity where it might assuage.

FRANKLIN'S MAXIMS.

1. Temperance. — Eat not to dulness; drink not to elevation.

2. Silence. — Speak not but what may benefit others or yourself; avoid trifling conversation.

3. Order. — Let all things have their places; let each part of your business have its time.

4. Resolution. — Resolve to perform what you ought; perform without fail what you resolve.

5. Frugality. — Make no expense but to do good to others or yourself; that is, waste nothing.

6. Industry. — Lose no time; be always employed in something useful; cut off all unnecessary actions.

7. Sincerity. — Use no hurtful deceit; think innocently and justly; and if you speak, speak accordingly.

8. Justice. — Wrong none by doing injuries, or omitting the benefits that are your duty.

9. Moderation. — Avoid extremes; forbear resenting injuries as much as you think they deserve.

10. Cleanliness. — Tolerate no uncleanliness in body, clothes, or habitation.

11. Tranquillity. — Be not disturbed at trifles, or at accidents, common or unavoidable.

HABITS OF A BUSINESS MAN.

A sacred regard to the principles of justice ought to form the basis of every commercial transaction, and regulate the conduct of the upright man of business.

He is strict in keeping his engagements.

He does nothing carelessly or in a hurry.

He employs no person to do for him what he can do for himself.

He keeps everything in its proper place, and does everything at its proper time.

He leaves nothing undone that ought to be done, and which circumstances permit him to do.

He keeps his designs and business from the knowledge of others.

He is prompt, decisive, civil, and obliging to his customers.

He does not overtrade his capital.

He prefers cash to credit, but, if credit is necessary, as short a time as possible.

He prefers small profits and certain returns to large profits and uncertain settlements.

He is clear and explicit in making a bargain.

He leaves nothing of consequence to memory which he can commit to writing

He will not be above his business.

He keeps copies of all important letters written by him, and carefully preserves all which he receives.

He is methodical in his habits and arrangements.

He is always at the head of his business.

He holds it as an axiom, that he whose credit is doubted should not be trusted.

He constantly examines his books, and sees that they are properly kept.

He makes a balance of the true state of his affairs at regular intervals.

He avoids lawsuits and accommodation bills.

He is economical in his expenditure, and lives within his income.

He is cautious in becoming security for any person.

He is generous, but not until he has been just.

Let a man of business conform strictly to these habits; when once formed they are easily retained, and success will result from their practice.

Let him take pleasure in his business, and it will become a recreation to him.

Let him hope for the best, be prepared for the worst, and bear resolutely whatever happens.

DILIGENCE IN BUSINESS.

Cultivate a spirit of diligence, both in your temporal and spiritual employ. Strictly adhere to your business: religion commands this. There may be difficulties in your calling, and so there are in every situation; but let not this relax your exertions, lest you give occasion for the enemy to speak ill of you. Besides, assiduity in your lawful concerns is one of the best ways to be preserved from temptation. Idleness has led to a thousand evil consequences;

while, in itself, it is a most unhappy state of mind to labor under. It is good to be employed. Action is really the life, business, and rest of the soul. "Idleness," as South says, "offers up the soul as a blank to the Devil, for him to write what he will upon it." Idleness is the emptiness, and business the fulness, of the soul; and we all know that we may infuse what we will into empty vessels, but a full one has no room for a further infusion. BUCK.

CAREFULNESS IN MONEY MATTERS.

Punctuality in money matters is one of the greatest sources of comfort and prosperity to the man of business,—indeed, to every man. Punctuality in payment may be said to double our means. The man of disorderly habits, with no proper account of income and expenditure, and no just estimate of the relative proportion of his means and obligations, is perpetually exposed to the annoyance and vexation of having demands made upon him, not so much beyond his means as disproportioned to the chance provisions of the moment. He may be compared to a general who, neglecting the discipline of his forces, may be surprised at any moment by the attack of the most insignificant foe, not because his numbers are insufficient, but because they are not at hand. The skilful commander, with but half the number, well disciplined, and ever ready at a moment's notice, is equal to almost any emergency.

He who aims at little may accomplish but little: therefore work for great or better things; let your aim and study be to advance yourself. If you aim at the sun you will not hit it: but the higher you aim and labor to reach, the further you will get; and whatever a man labors for, in an earnest and systematic way, he will generally attain.

A sensible employé will make his employer's interest his own; and to that end he will endeavor to acquire a thorough knowledge of the details of the business, and do all in his power to honorably advance the interests of the house; for by so doing he will make himself in a great measure indispensable to his employer, which, of course, will undoubtedly have a beneficent effect on his own welfare.

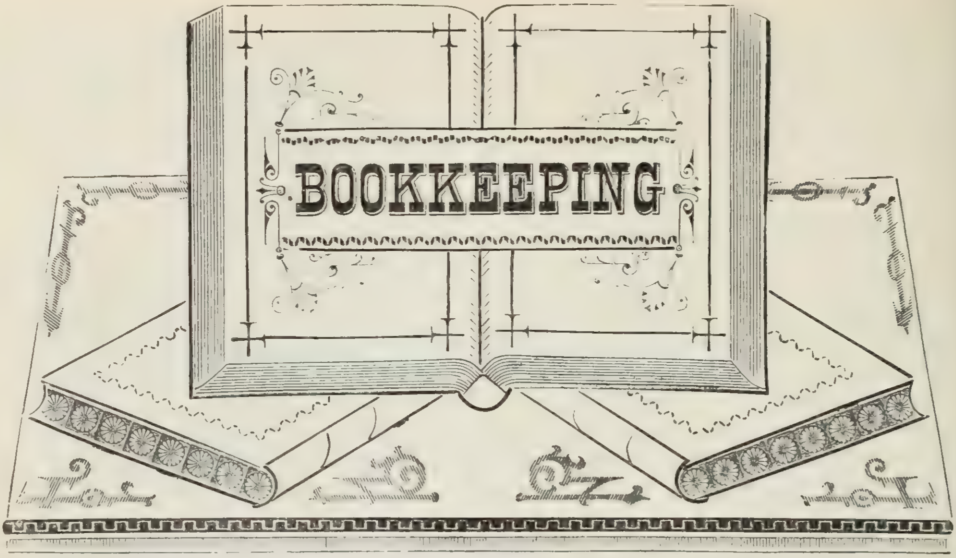
Time is money: therefore devote every moment of it to the attainment of some definite object; and this must be done, if at all, in a methodical manner. If there is any information in this or any other book which you wish to acquire, do not simply read, but study it. Vigor of body begets vigor of mind: therefore take care of your body and keep good hours, and remember that one hour's sleep before midnight is better than two afterwards.

SURETYSHIP.

Amongst all other things of the world, take care of thy estate, which thou shalt ever preserve, if thou observe three things: first, that thou know what thou hast; what everything is worth that thou hast; and to see that thou art not wasted by thy servants and officers. The second is, that thou never spend anything before thou have it; for borrowing is the canker and death of every man's estate. The third is, that thou suffer not thyself to be wounded for other men's faults, and scourged for other men's offences, which is the surety for another; for thereby millions of men have been beggared and destroyed, paying the reckoning of other men's riot, and the charge of other men's folly and prodigality. If thou smart, smart for thine own sins; and, above all things, be not made an ass to carry the burdens of other men. If any desire thee to be his surety, give him a part of what thou hast to spare; if he press thee farther, he is not thy friend at all, for friendship rather chooseth harm to itself than offereth it.

Lend not to him that is mightier than thyself, for if thou lendest him count it but lost. Be not surety above thy power, for if thou be surety think to pay it.

SIR WALTER RALEIGH.



BOOKKEEPING

THE aim of the following pages is to present in clear, plain language the essential elements of the science and art of bookkeeping. In the limited space at command, no elaborate details could be discussed; yet nothing of general importance has been omitted. All the problems and difficulties which are met in keeping even the simplest set of books are either actually solved and explained, or may be readily understood, by the application of the principles set forth.

As the extent of detail and fulness of record vary with the desires of the merchant or the necessities of his business, purely local peculiarities have been passed over, or, if introduced at all, have received no undue prominence. The briefest possible explanations have at all times been adopted, and the illustrations selected to assist the student, not to confuse or perplex him.

We cannot too earnestly recommend most careful consideration of the practical portion of the work, for a thorough analysis of the forms and elements there exhibited will prove more beneficial than many pages of written description. With these few words, let us pass to the consideration of the subject itself.

I. INTRODUCTION.

Let us imagine ourselves engaged in farming, and just ready to commence operations for another year. We have concluded to devote our land this season to the raising of corn; and, for the purpose of comparing results with last year's operations in wheat, we shall make a memorandum of every dollar and cent expended on the cornfield, as well as of all sums received from sales of its products. A small sheet of writing-paper will answer our purpose. Dividing this sheet by a line down the middle (see illustration following), we can place to the left the items of expenditure; to the right, the sales as they are made. When the crop has been disposed of, the difference between the two sides will show whether we have gained or lost in our corn speculation; and a knowledge of this fact will, no doubt, help us to lay our plans better for the next season.

CORNFIELD (75 ACRES).

Expenses.			Sales.		
May 5.	60 days' ploughing, @ $2.50 ..	$150 00	Nov. 1.	500 bushels, @ 50c. cash	$250 00
" 11.	12 " harrowing, @ $2.00 ..	24 00	" 5.	Peter Jones, on account, 1,000 bushels, @ 55c.............	550 00
" 14.	25 " marking out, @ $2.00,	50 00	" 10.	Peter Jones, on account, 500 bushels, @ 60c.............	300 00
" 14.	10 bushels seed-corn, @ $1.50..	15 00	" 12.	James Reilly, on account, 250 bushels, @ 60c.............	150 00
" 14.	35 days' planting, @ $1 50....	52 50	" 15.	Peter Jones, on account, 833⅓ bushels, @ 60c	500 00
" 30.	40 " cultivating, @ $2.00..	80 00	" 20.	James Reilly, on account, 2,000 bushels, @ 60c	1,200 00
June 15.	40 " ploughing, @ $2 50 ..	100 00	" 21.	Cash, 1,750 bushels, @ 50c....	875 00
Sept. 15.	50 " husking and binding stalks, @ $5 00............	250 00	" 22.	My own use, 200 bushels, @ 60c ,	120 00
Dec. 15.	Gain	3,298 50	" 23.	75 loads stalks, @ $1.00.......	75 00
		$4,020 00			$4,020 00

During the course of our operations, however, we have been compelled to deliver some of our corn to those who were in need of it, but had no money to pay with at the time. Not to forget these deliveries, we have recorded them in detail in our cornfield statement; but it will be an additional convenience to write the names of such parties on a separate slip of paper, similar to the first, and under each name in the left column place the number of bushels and value of the corn as delivered. Later on, as payments are made, we record them in the right-hand column, and thus are able to tell at a glance how much any of our neighbors owe us.

PETER JONES.

Bought of Us.			Paid.		
Nov. 5.	1,000 bushels corn, @ 55c.....	$550 00	Nov. 12.	Cash........................	$400 00
" 10.	500 " " @ 60c.....	300 00	" 20.	"	200 00
" 15.	833½ " " @ 60c.....	500 00	" 25.	"	300 00
		$1,350 00	Dec. 15.	" to close	450 00
					$1,350 00

JAMES REILLY.

Bought of Us.			Paid.		
Nov. 12.	250 bushels corn, @ 60c.....	$150 00	Nov. 15.	Cash........................	$150 00
" 20.	2,000 " " @ 60c.....	1,200 00	Dec. 1.	"	500 00
		$1,350 00	" 15.	"	400 00
			" 30.	" to close	300 00
					$1,350 00

During the course of the season we have been obliged to purchase, at the village store, articles of food and clothing for which we promised to pay later on, — say when our crop was harvested, — and hence have found it well to keep on a third slip of paper a brief account of the articles thus bought and payments made from time to time, from which we can readily tell, whenever desired, exactly how much we owe the storekeeper.

STOREKEEPER.

Paid Him.			Bought of Him.		
May 30.	Cash	$100 00	May 20.	Boots for myself	$10 00
Sept. 5.	"	50 00	" 30.	Provisions for three months	150 00
Nov. 10.	"	50 00	June 30.	Furniture	10 00
Dec. 30.	" in settlement	65 00	Aug. 15.	Provisions, per bill	25 00
			Oct. 20.	Clothing, per bill	20 00
		$265 00	Dec. 30.	Provisions	50 00
					$265 00

In doing what we have above described, we have been really engaged in the *Art of Bookkeeping;* and the object for which we have kept these rude records is the same which prompts the keeping of books everywhere, — viz., a methodical record of the state and progress of one's affairs. Similar records can be easily kept by persons in every sphere of life; by the blacksmith, the miller, the shoemaker, the teacher, the physician, the lawyer.

If, to the records we have already mentioned, a detailed memorandum of our receipts and expenditures of money is added, we increase still more the usefulness of our work, and really have a system of bookkeeping of as full a nature as is ordinarily necessary in a moderate-sized business.

Bookkeeping, as practised in business circles, no matter how elaborate or numerous its details, is but making the preceding plain records in a convenient and systematic manner.

II. SINGLE ENTRY.

Two systems of bookkeeping are found throughout the commercial world, and are called respectively *Single Entry* and *Double Entry* bookkeeping, — terms which will be fully explained elsewhere.

We will first examine the nature of SINGLE ENTRY, — a system adapted more especially to the wants of a small business, though frequently employed in establishments of more generous proportions.

DAY BOOK. — The first essential feature of this method is a memorandum of events or transactions in the order of their occurrence, usually kept in what is called the Day-Book.

The DAY BOOK is really a diary or written memorandum. The entries are made as the transactions occur, and the book has therefore been called a book of original entry. One form of this book is shown in our illustrative set.

LEDGER. — This memorandum of daily events simply fastens them on paper; but to ascertain what is due us from any person at any time, or how much we ourselves have yet to pay another, we must record somewhere by themselves all our transactions with the party mentioned. Such a record is an *account*, and is kept in a book called the *Ledger*, the second essential feature in this species of bookkeeping. The Ledger, then, is the book of accounts. By referring to the illustrative set, it will be seen that each page of this book is divided by a triple line into two main divisions, — the one to the left called the *Debtor* or *Debit* side, that to the right the *Creditor* or *Credit* side.

A DEBTOR is one who owes us; a CREDITOR, one who trusts or loans. Hence my Debtors are those who owe me; my Creditors, those whom I owe. Under a party's name in our Ledger, therefore, we place on the Debit side of the page, or account, all amounts which he owes us, or for which he is Debtor to us; and, on the Credit side of the account, all sums by which his indebtedness to us is diminished, — the difference between the two sides showing his net indebtedness to us at any time.

Again, we place to the Credit side of an individual's account all things that he loans or trusts us with, — the sums for which he becomes our Creditor. On the Debit side of this account will appear all diminutions of this Credit by payment or otherwise; the excess of the Credit side over the Debit showing what we owe the party.

POSTING. — Carrying transactions from the Day-Book and other books into the proper places or accounts in the Ledger is called *posting*.

PROPRIETOR'S, OR OWNER'S ACCOUNT. — Business pursuits are engaged in for the purpose of acquisition; and hence one of the great objects of keeping accurate records of our operations is to enable us to ascertain what our gains in stated intervals are.

If we commence business at the first of the year with $500 capital (stock of goods and money, including uncollected accounts due us, and deducting debts incurred by us and unpaid), and at its close discover our capital to be $600, we conclude very properly that we have gained $100 in business during the year; or if our capital at the close is $400, we certainly have lost $100 in the same period. How much our capital may be, can readily be told at any time, say the close of the year, by a few simple observations and calculations, as will be shown later on.

If then we have a record somewhere in our books of our capital at the beginning of the year, the two facts will enable us to determine, as already exemplified, our gain or loss in the year's transactions.

Such a record is kept in an account generally called *Stock*, which is merely a substitute for the proprietor's own name. But as the title "stock" is liable to be confounded with other accounts, such as "stock in trade," of "goods on hand," or with "joint-stock companies," we will here use the term "proprietor," though the firm's name can be used, or the title "capital."

When we trust a scheme or enterprise sufficiently to invest money therein, it certainly owes us or is our Debtor, or we its Creditor, for the amount invested; hence, as we are keeping the books of our business (not of ourselves), we should credit *proprietor* with all investments, and *vice versa*, debit it for all withdrawals of capital.

CASH ACCOUNT. — The key-note to economy is to know exactly when, why, and how much we expend. It will therefore be found extremely desirable and serviceable to keep a detailed record of all our receipts and disbursements of money. This is usually done in an account called *Cash*, which is debited for receipts and credited for disbursements.

Cash account is really the account of our wallet or money drawer with the business. When money is deposited therein, the Cash drawer owes us or becomes our Debtor, and the account is properly debited; when this indebtedness of the Cash drawer is diminished by the removal of any sums, we should credit for the diminution, as already explained in personal accounts.

The importance of keeping the Cash account cannot be too strongly urged. True, we can always tell how much money we have in our pocket by counting it; but if the amount as thus ascertained agrees with the difference between our recorded receipts and expenditures, we will have greater confidence in ourselves, and being able to account satisfactorily for every penny that has passed through our hands, we will be satisfied that nothing has gone astray. Besides, the mere keeping of this account is apt to produce habits of economy and frugality, whose influence will be plainly shown in our private and business affairs.

CASH BOOK. — Because of the numerous details involved, it is often advantageous to keep this account of Cash, not in the Ledger, but in a book by itself called the *Cash Book*, the left page of which is devoted to the Debits, and the right to the Credits, leaving ample space for explanations.

With these brief instructions, we refer the reader to the illustrative set which follows, asking his close attention to the forms of books and entries there presented.

REMARKS ON THE SINGLE ENTRY SET.

We have employed in this illustrative set a Day Book, Cash Book, and Ledger, the other or subsidiary books being introduced as samples only.

Day Book. — This needs no explanation, except that the figures in the narrow column on the left show the page of the Ledger to which each entry has been carried; and the figures in the middle of the line separating the entries, the day of the month.

Cash Book. — The form we present is most generally used, is easy to understand and convenient in practice, though frequently all the items are kept on one page; in which case two money columns are necessary, one for the Debits and one for the Credits. This latter form, however, is apt to lead to serious errors, and hence is objectionable.

Ledger. — All that it is necessary to say of this book is, that the figures in the column preceding the money columns are the pages of the Day Book or Cash Book from which these entries are taken. Another less perfect form of the Ledger is one in which the Debit and Credit entries are made promiscuously under each other, the amounts only being separated by carrying them into Dr. and Cr. money columns, on the right of the page.

Bill Book. — An attentive examination of this will explain its scope and purpose sufficiently. A monthly bill book — another form — is also used, wherein, after the bills payable and receivable are set down, the open accounts can be added, thus taking the place of the "Cash Tickler" (explained farther on). In the monthly bill book the notes are not set down as issued, so perhaps the first form is better, and will be used in this work.

Ledger Index. — This is usually found at the beginning of the Ledger, one or more pages being devoted to each letter of the alphabet. Sometimes it is found more convenient to have the Index in a book by itself.

Sales Book. — We present a few sample entries, showing the form and nature of the book. The items may be posted direct into the Ledger, or passed through the Day Book and Cash Book.

Inventory. — An inventory is an itemized list of our merchandise and other tangible property, made from actual count or survey. Several forms could be employed, of which we give one possessing many advantages.

Statement. — This document needs no elaborate explanation. Careful inspection will suffice to make it clear.

After the practical set which we present will be found a list of transactions continuing the business for another month. These will afford an opportunity for practice to those who desire it.

TRANSACTIONS.

BOSTON, May 1, 1882.—I commence business this day with the following property:—

Cash,	$600 00
Geo. Dana owes me	50 00
Thomas Young owes me	100 00
Total,	$750 00

May 2. Bought of Jas. Cole on %.,		
160 lbs. best Mocha coffee, @ 40c.,	$64 00	
70 " Oolong tea, @ $1,	70 00	$134 00
May 3. Bought of J. F. Wilkins for cash,		
20 bbls. family flour, @ $8,	$160 00	
1 hhd. 1,400 lbs. sugar, @ 16c.,	224 00	384 00
May 4. Sold Geo. Dana on %.,		
2 bbls. family flour, @ $9,		18 00
May 5. Bought of Robt. Barnum on %.,		
30 pairs boys' shoes, at $2,		60 00
May 6. Sold for cash,		
20 lbs. sugar, @ 25c.,	$5 00	
1 bbl. flour,	9 00	14 00
May 8. Bought of M. Drewes on %.,		
100 yds. broadcloth, @ $2,		200 00
May 9. Recd. $25 cash from Geo. Dana on %.,		
May 10. Bought for cash,		
100 lbs. starch, @ 9c.,		9 00
May 12. Sold Thomas Young on %.,		
2 bbls. flour, @ $9,	$18 00	
20 lbs. coffee, @ 60c.,	12 00	
100 " sugar, @ 25c.,	25 00	55 00
Received his note @ 30 days, in settlement of %., $55.		
May 13. Sold for cash,		
10 yds. cloth, @ $3,	$30 00	
5 pairs shoes, @ $3,	15 00	
20 lbs. tea, @ $1.40,	28 00	
10 " starch, @ 13c.,	1 30	$74 30
May 15. Paid Michael Drewes on %. my 60-days note for	$150 00	
Cash,	50 00	200 00
May 16. Paid rent of store for this month,		10 00
May 17. Paid Cole $50 cash on %.		
May 18. Sold Wm. Peters,		
100 lbs. sugar, @ 25c.,		25 00
May 19. Bought of M. Drewes,		
200 yards sheeting, @ 16c.,		32 00
May 20. Sold for cash,		
5 pairs shoes, @ $3,	$15 00	
10 lbs. coffee, @ 60c.,	6 00	
40 " sugar, @ 25c.,	10 00	31 00
May 22. Paid for fuel, etc.,		2 50
May 24. Sold Peter Thomson %.,		
10 pairs shoes, @ $3,	$30 00	
20 yards cloth, @ $3,	60 00	
100 " sheeting, @ 25c.,	25 00	115 00
May 26. Received Wm. Peters's note @ 10 days for $25.		
May 29. Sold M. Drewes on %.,		
10 lbs. starch, @ 25c.,		2 50
May 29. Sold Peters,		
50 yards sheeting, @ 25c.,	$12 50	
10 lbs. tea, @ $1.35,	13 50	26 00
May 31. Paid for stationery, postage, etc.,		3 00
Inventory of merchandise,		505 34
Others' notes on hand,		180 00
My note unpaid,		150 00

Find capital, June 1, and gain for month of May.

DAY BOOK.

BOSTON, MAY 1, 1882.

1	PROPRIETOR.	*Cr.*		
	For investment, viz.: —			
	Cash,	$600 00		
1	George Dana owes me	50 00		
1	Thomas Young do.	100 00	$750	00
	2			
1	JAMES COLE,	*Cr.*		
	160 lbs. Mocha coffee, @ 40c.,	$64 00		
	70 " oolong tea, @ $1,	70 00	134	00
	4			
1	GEORGE DANA,	*Dr.*		
	2 bbls. family flour, @ $9,		18	00
	5			
2	ROBERT BARNUM,	*Cr.*		
	30 prs. boys' shoes, @ $2,		60	00
	8			
2	MICHAEL DREWES,	*Cr.*		
	100 yds. broadcloth, @ $2,		200	00
	12			
1	THOMAS YOUNG,	*Dr.*		
	2 bbls. flour, @ $9,	$18 00		
	20 lbs. coffee, @ 60c.,	12 00		
	100 " sugar, @ 25c.,	25 00	55	00
	12			
1	THOMAS YOUNG,	*Cr.*		
	Note @ 30 days, in settlement of %.,		155	00
	15			
2	MICHAEL DREWES,	*Dr.*		
	My note @ 60 days,	$150 00		
	Cash,	50 00	200	00

2 DAY BOOK.

BOSTON, MAY 17, 1882.

1	James Cole,	*Dr.*		
	Cash on %.,		$50	00
	18			
2	William Peters,	*Dr.*		
	100 lbs. sugar, @ 25c.,		25	00
	19			
2	M. Drewes,	*Cr.*		
	200 yds. sheeting, @ 16c.,		32	00
	24			
2	Peter Thorn,	*Dr.*		
	10 prs. shoes, @ $3,	$30 00		
	20 yds. cloth, @ $3,	60 00		
	100 " sheeting, @ 25c.,	25 00		
			115	00
	25			
2	William Peters,	*Cr.*		
	Note @ 10 days, my favor,		25	00
	29			
2	William Peters,	*Dr.*		
	50 yds. sheeting, @ 25c.,	$12 50		
	10 lbs. tea, @ $1.35,	13 50		
			26	00
	30			
2	M. Drewes,	*Dr.*		
	10 lbs. starch @ 25c.		2	50
	9			
1	George Dana,	*Cr.*		
	Cash on %.,		25	00

CASH BOOK. 1

CASH. RECEIPTS.

1882.					
May	1,	INVESTMENT,		$600	00
"	6,	Sold 20 lbs. sugar, @ 25c.,	$5 00		
		1 bbl flour, " $9,	9 00	14	00
		Geo. Dana pays on %.,		25	00
"	7,	Sold 10 yds. cloth, @ $3,	$30 00		
"	13,	5 prs. shoes, " 3,	15 00		
		20 lbs. tea, " 1.40,	28 00		
		10 " starch, " 13c.,	1 30	74	30
"	20,	Sold 5 prs. shoes, " $3,	$15 00		
		10 lbs. coffee, " 60c.,	6 00		
		40 " sugar, " 25c.,	10 00	31	00
				$744	30
June	1,	Balance on hand.		$235	80

SALES BOOK. 1

BOSTON, MAY 4, 1882.

	1	GEO. DANA, on %.,			
		2 bbls. flour, @ $9,	$18 00	$18	00
		6			
	C. B.	CASH,			
		20 lbs. sugar, @ 25c.,	$5 00		
		1 bbl. flour, " $9,	9 00	14	00
		12			
	1	THOMAS YOUNG, on %.,			
		2 bbls. flour, @ $9,	$18 00		
		20 lbs. coffee, " 60c.,	12 00		
		100 " sugar, " 25c.,	25 00	55	00

CASH BOOK.

Cash. Payments.

1882.					
May	3,	Bot. 20 bbls. flour, @ $8,	$160 00		
"	3,	" 1,400 lbs. sugar, @ 16c.,	224 00	$384	00
"	10,	" 100 " starch, @ 9c.,		9	00
"	15,	Paid M. Drewes on %.,		50	00
"	16,	Rent of store for May,		10	00
"	17,	Paid James Cole on %.,		50	00
"	22,	Fuel, etc.,		2	50
"	31,	Stationery,		3	00
"	31,	Balance on hand,		235	80
				$744	30

INDEX TO LEDGER.

A 1	G, H 2	P, Q 3 Peters, William, 2
B Barnum, Robert, 2	I, J	R
C Cole, James, 1	K	S Stock, 1
D Dana, George, 1 Drewes, Michael, 2	L	T Thorn, Peter, 2
E	M	U, V, W
F	N	X, Y, Z Young, Thomas, 1
	O	

LEDGER. 1

Dr. PROPRIETOR. Cr.

1882.						1882.					
						May	1,	Cash.	1	$750	00

Dr. GEORGE DANA. Cr.

1882.						1882.					
May	1,	Old debt.	1	$50	00	May	9,	Cash.	1	$25	00
“	4,	Mdse.	1	18	00						

Dr. THOMAS YOUNG. Cr.

1882.						1882.					
May	1,	Old debt.	1	$100	00	May	12,	Note.	1	$155	00
“	12,	Mdse.	1	55	50						

Dr. JAMES COLE. Cr.

1882.						1882.					
May	17,	Cash.	2	$50	00	May	2,	Mdse.	1	$134	00

2 LEDGER.

Dr. WILLIAM PETERS. Cr.

1882.						1882.					
May	18,	Mdse.	2	$25	00	May	25,	Note.	2	$25	00
“	29,	Mdse.	2	26	00						

Dr. ROBERT BARNUM. Cr.

1882.						1882.					
						May	5.	Mdse.	1	$60	00

Dr. MICHAEL DREWES. Cr.

1882.						1882.					
May	15.	Sundries.	2	$200	00	May	8,	Mdse.	1	$200	00
“	30,	Mdse.	2	2	50	“	19,	Mdse.	2	32	00

Dr. PETER THORN. Cr.

1882.						1882.					
May	24,	Mdse.	2	$115	00						

INVENTORY OF MDSE., JUNE 1, 1882.

15	bbls.	flour,	@	$8	00	$120	00	$	
130	lbs.	coffee,	"		40	52	00		
1,140	"	sugar,	"		16	182	40		
40	"	tea,	"	1	00	40	00		
80	"	starch,	"		9	7	20		
10	prs.	shoes,	"	2	00	20	00		
70	yds.	cloth,	"	2	00	140	00		
50	"	sheeting,	"		16	8	00	569	60

STATEMENT, JUNE 1, 1882.

ASSETS OR PROPERTY.					
1. Ledger Accounts:		$		$	
Geo. Dana owes me	$43 00				
Wm. Peters " "	26 00				
Peter Thorn " "	115 00	184	00		
2. Cash on hand,		235	80		
3. Mdse. as per inventory,		569	60		
4. Others' notes on hand,		180	00	1169	40
LIABILITIES OR DEBTS.					
1. Ledger Accounts:					
Jas. Cole: I owe him	$84 00				
Rob. Barnum, " "	60 00				
M. Drewes, " "	29 50	$173	50		
2. My notes unpaid,		150	00	323	50
Net worth June 1,				$845	90
" " May 1,				750	00
Gain in May,				$95	90

BILL BOOK.

BILLS RECEIVABLE.

No.	When Received.		Drawer or Indorser.	Drawer or Maker.	Date.		Time.	When Due.		Amount.		When and How Disposed Of
1	May	12	Thos. Young,	Thos. Young,	May	12	30 days,	June	12–15	$155	00	
2	"	25	Wm. Peters,	Wm. Peters,	"	25	10 "	"	4–7	25	00	

BILLS PAYABLE.

No.	When Issued.		Drawer or Indorser.	Drawer or Maker.	Date.		Time.	When Due.		Amount.		When and How Redeemed.
1	May	15	Myself,	Myself,	May	15	60 days.	July	15–18	$150	00	

[PRACTICE SET.]

TRANSACTIONS.

June 1. Continue business of illustrative set for another month. Open books as though commencing a new business, with capital as given in the statement of resources and liabilities.		
June 1. Sold for cash,		
1 bbl. flour,	$8 50	
10 lbs. coffee, @ 45c.,	4 50	
2 pairs shoes, @ $2.50,	5 00	$18 00
June 2. Received from Peter Thomson %.,		50 00
" " Paid Robt. Barnum in full of %.,		60 00
June 4. Received cash in payment of Peters's note, due this day,		25 00
June 5. Sold Geo. Dana,		
10 lbs. tea, @ $1.25,	$12 50	
15 yards cloth, @ $2.50,	37 50	50 00
Received cash on %.,		40 00
June 6. Paid rent for this month,		10 00
Sold 5 lbs. starch, @ 10c.,	$0 50	
10 yards sheeting, @ 20c.,	2 00	2 50
June 7. Paid Cole on %.,		50 00
June 8. Sold Peters,		
100 lbs. sugar, @ 20c.,	$20 00	
2 bbls. flour, @ $10,	20 00	40 00
June 9. Sold for cash,		
50 lbs. sugar, @ 20c.,	$10 00	
10 yards cloth, @ $3,	30 00	40 00
June 11. Paid cash for sign,		5 00
" " Sold Thomas Young,		
50 lbs. sugar, @ 20c.,	$10 00	
5 " tea, @ $2,	10 00	20 00
June 12. Received payment for Thomas's note, due this day,		155 00
June 13. Sold Drewes,		
5 bbls. flour, @ $10,		50 00
June 14. Thom paid me balance of %.,		65 00
June 15. Paid my note, due to-day,		150 00
Sold for cash, 1 bbl. flour,		10 00
June 16. Paid gas and fuel,		5 00
Sold for cash, 2 pairs shoes, @ $3,		6 00
June 18. Received of M. Drewes on %.,		20 50
June 19. Sold Robt. Barnum,		
80 lbs. sugar, @ 20c.,	$16 00	
20 " coffee, @ 50c.,	10 00	
5 " tea, @ $1.20,	6 00	32 00
June 20. Received from Thos. Young on %.,		10 00
June 21. Received from Peters on %., his note @ 30 days for		$66 00
June 22. Paid Cole on %.,		24 00
June 23. Sold for cash,		
40 yards sheeting, @ 20c.,	$8 00	
25 " cloth, @ $3,	75 00	83 00
June 25. Sold Thomas Young,		
60 lbs. sugar, @ 20c.,	$12 00	
10 " tea, @ $1.50,	15 00	27 00
June 26. Sold for cash,		
2 bbls. flour, @ $10,		20 00
June 27. Paid clerk's salary for 2 months,		30 00
June 28 Sold Robt. Barnum on %.,		
10 yards cloth, @ $3,		30 00
June 29. Sold Wm. Peters		
15 lbs. starch, @ 10c.,	$1 50	
100 lbs. sugar, @ 20c.,	20 00	21 50
June 30. Paid for wrapping paper, twine, nails, and other supplies, as per bill of hardware man,		5 00

INVENTORY OF MERCHANDISE ON HAND JUNE 30.

4 bbls. flour, @ $8,	$32 00	
100 lbs. coffee, @ 40c.,	40 00	
700 " sugar, @ 16c.,	112 00	
10 " tea, @ $1,	10 00	
60 " starch, @ 9c.,	5 40	
6 pairs shoes, @ $2,	12 00	
10 yards cloth, @ $2,	20 00	$231 40

STATEMENT.

Resources or Property.

1. Debts due me from different parties, as shown in ledger,	$173 50	
2. Cash on hand,	441 80	
3. Merchandise as per invent'ry,	231 40	
4. Others' notes,	66 00	$912 70

Liabilities or Debts.

1. I owe Jas. Cole,	10 00
Net worth, July 1,	$902 70
" " June 1,	845 90
Gain during June,	$56 80

III. DOUBLE ENTRY.

The method of book-keeping just treated is, as already stated, adequate for a moderate-sized business. Even in its highest and most developed form, however, it is but a crude and imperfect record of one's affairs, especially when compared with the plan which we are about to unfold. In the preceding system we learn the condition of our business by ascertaining at stated intervals exactly what we are worth, being then able to measure our progress between two such intervals by simple subtraction.

In Double Entry book-keeping we ascertain and record our losses and gains as they occur, independently of our capital; and as this result should agree exactly with that obtained by the Single Entry method, a check upon the correctness of our work is afforded. Double Entry, then, arrives at its conclusions or exhibition of results in two different ways.

In order to effect this purpose, all the possible relations involved in a transaction must appear in our books. This is made practicable by treating things like merchandise, cash, others' notes, and our own notes, as active agents, and keeping a record with them accordingly. The Ledger, as before, is of course the main book, but instead of containing only personal accounts, exhibits all the following results: —

1. Capital on hand.
2. What others owe us.
3. What we owe others.
4. Money on hand.
5. Others' notes unpaid in our possession.
6. Our notes outstanding and unpaid.
7. Losses and gains on business enterprises.
8. Incidental losses or gains.

These results are obtained in each case by grouping, under proper Ledger titles, two opposite (though similar) kinds of facts. One class is placed to the left or Dr. side of the account, the other to the right or Cr. side. These words Dr. and Cr. were originally applied only to personal accounts, but are now of more extended application, and practically serve to distinguish the two classes of facts found under each Ledger title.

Many clap-trap rules have been given, condensing the art of ascertaining the Debits and Credits of all transactions into a rhythmic line or two; but these are in every instance of partial application only. A careful study of the following diagrams will enable any one to understand this subject readily. This meaning of the words Dr. and Cr. (quite arbitrary in some instances) is in each class of accounts briefly and graphically illustrated.

Dr. PROPRIETOR. *Cr.*

Amounts *Withdrawn* from business.	Amounts *Invested.*

Dr. JAMES CARLETON. *Cr.*

Amounts *Bought* of us by Carleton.	Amounts *Paid* us by Carleton.

Dr. PETER WANAMAKER. *Cr.*

Amounts *Paid* him by us.	Amounts we *Bought* of him.

CASH.

Dr.	*Cr.*
Amounts *Received.*	Amounts *Paid out*

BILLS RECEIVABLE.

Dr.	*Cr.*
Others' notes *Received.*	Others' notes *Redeemed.*

BILLS PAYABLE.

Dr.	*Cr.*
Our notes *Redeemed.*	Our notes *Issued.*

MERCHANDISE.

Dr.	*Cr.*
Cost or Outlay.	Returns or Sales.

EXPENSE.

Dr.	*Cr.*
Outlay or Loss.	Returns or Gain.

Every transaction, from the simplest to the most complicated, can be resolved into a number of debit and credit relations, the sum of either class exactly equalling the sum of the other. This is the keystone in the science of book-keeping or accounts. *The sum of the Debits must always equal the sum of the Credits.* But four possible arrangements of Debits and Credits can occur, and the rule holds good in each as illustrated by the diagrams: —

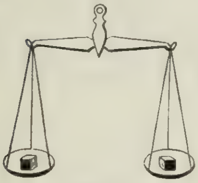


FIG. I.

I. One Debit and one Credit.

II. Two or more Debits and one Credit.

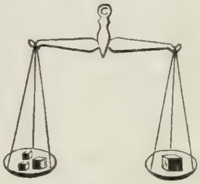


FIG. II.

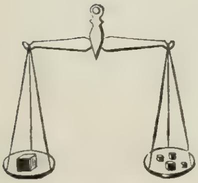


FIG. III.

III. One Debit and two or more Credits.

IV. Two or more Debits and two or more Credits.

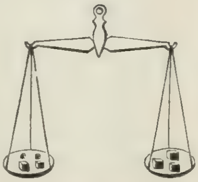


FIG. IV.

Double Entry book-keeping, then, is characterized: 1, By its taking into consideration *all* the Debits and *all* the Credits involved in every transaction; and 2, by the sum of the Debits and the sum of the Credits always being equal. As this latter is true of every transaction taken by itself, it will certainly prove true when all the transactions are combined; therefore the sum of all the Debits in the Ledger should always be equal to the sum of all the Credits. This last case furnishes a proof of the accuracy of our posting.

To ascertain at any time if the two sides of the Ledger agree, a list of the accounts is made, and the sum of the Debits and Credits of each placed opposite. Such a document is called a Trial Balance. This should be made quite frequently, certainly no less than once a month; for nothing is better in book-keeping than to feel sure of our records as they are being made, then to discover and rectify mistakes as soon after they occur as possible.

Subdivision of Accounts. — Though we have above given all the accounts necessary in a perfectly scientific Double Entry system of books, still it is often advantageous to split up some of these, as, for example, 7 and 8, into a number of accounts, each of which, being but a subdivision of the main account, is debited and credited in exactly the same manner. Thus, merchandise may be divided into flour, rye, wheat, corn, oats, provisions, etc., or in another branch of industry, into cotton goods and woollen goods; briefly, into such divisions as the nature of the business renders convenient or necessary. Similarly, expense account may be divided into insurance, freight, drayage, stationery, repairs, etc., — circumstances here, as before, modifying the choice of divisions.

It is highly desirable to have among the divisions of expense an account called Loss and Gain, which is debited for all incidental or otherwise unclassifiable losses, and credited for similar gains, and into which all losses and gains may be carried at the end of the year, for summarizing and ascertaining the net loss or gain during that period.

Definition of Single Entry. — Although we have already given a set of books illustrative of Single Entry, still the term Single Entry is not applied wholly to that form. Frequently books will be found in which some of the before-mentioned eight classes of accounts, other than personal accounts, are introduced, — for example, merchandise or expense; but unless *all* the Debits and *all* the Credits of every transaction are entered, we very properly denominate the method Single Entry. Anything short of full Double Entry we call Single Entry.

Check of Double Entry. — By examining the tables, it will be seen that the first six classes of accounts have to do only with the financial part of the business; hence they may be called *Financial Accounts.* They show only the *condition* of our affairs brought about by our dealings, and are the same in general appearance in every branch of business. The other two groups treat, however, of the *progress* of our affairs, and may properly be termed *Business Accounts.* They show the transactions as they really occur. In them is to be found the real difference between the books of different commercial interests.

From the financial accounts we obtain our present worth, from the business accounts our net loss or gain for a given period. This latter, subtracted from or added to our capital at the commencement of the period taken, gives the same present worth as the financial accounts exhibit, — another way of stating the check of the Double Entry system.

Journal. — We have already seen that the ascertainment of the proper Debits and Credits to be made for each transaction is an important part of the book-keeper's work; indeed, it is the main part. Upon this depends the accuracy of his books. To facilitate correctness in this particular, it has been found highly desirable to make a list of the proper Debits and Credits of each transaction, before actually carrying them into the Ledger, — *i. e.*, before posting them. Such a list is made in the Journal.

It was formerly customary in Double Entry book-keeping to make this a distinct book by itself, entering the transactions as they occurred in a Day-Book, much similar to the Single Entry Day-Book. But this involved a great deal more work than is necessary, and hence it is now an almost universal custom to combine the two books in one form, calling it either Day-Book or Journal, sometimes Journal Day-Book. We will adopt the second name.

By reference to the Journal in our illustrative set, it will be seen to contain a list of the Debits and Credits of each transaction, together with a full explanation thereof. The Debits appear close up to the line ruled down the left of the page, the Credits are indented uniformly a half-inch. Many different arrangements of this book will be found, either particularly suiting the needs of the business using them, or meeting the caprice of the person keeping the books. We think the plan we present as simple as any, and recommend it for careful consideration.

Trial Balance. — To facilitate the closing of the books (a process described farther on), and at the same time to present in the smallest possible space all the important results of the business for the year, it is usual to prepare from the Ledger a number of statements, which will furnish this information almost at a single glance.

The first of these documents is universally of the same form and style. It is called a Trial Balance, and is taken to ascertain whether or not the Ledger is in balance. If from this abstract it is found that the Ledger is not in equilibrium, we infer that a mistake has been made, and the task remains to discover and rectify it. By comparing the balance of cash account with the cash on hand, and the balance of Bills Receivable account with notes in our possession, it can easily be ascertained if we have made a mistake in these accounts. If not thus found, we should see if the error was in adding up the Debits and Credits of any accounts, and look carefully for mistakes which might result from bad figures or an imperfect arrangement. If the error is still undetected, we must check our posting, starting from the last Trial Balance.

The Trial Balance, however, must not be regarded as an absolutely perfect detector of mistakes; on the contrary, it is but in a limited degree serviceable for this purpose. We might readily post, *e. g.*, to the correct side of the Ledger, but to the wrong account, yet the error would not appear in the Trial Balance.

Balance Sheet. — From the Trial Balance we make a statement or statements which will show all the other results aimed at in Double Entry book-keeping. We give some of the numerous forms which may be used.

The first consists of two separate exhibits, one called a Financial Statement, the other a Business Statement. A careful analysis will suffice to explain them.

The second form, though more complicated in appearance, is but a combination of the two reports first presented. Forms like it are called Balance Sheets, and a statement of results similar in design and purpose, if not in form, should always be made before the books are closed, for any mistake of consequence in the Ledger will be then revealed, and can be sought for and rectified. Only when the books are perfectly correct can the Ledger be properly closed.

Closing the Ledger. — Having completed the posting of a year's business, we will be ready to ascertain our present condition, and our progress during the year. For this purpose we must put our accounts in proper shape; that is to say, we must find and make the books exhibit our losses and gains, and our present worth. This is called closing the Ledger, and the necessary steps are: —

1. Credit the proper accounts with inventories of goods on hand. (It will be remembered that the Dr. side of such accounts as merchandise shows outlay or cost; the Cr. side, returns or amounts of sales. But the returns of the Cr. side are only for the goods *sold*, while the Dr. side shows the cost of all goods bought. If, therefore, we subtract from the Dr. side the present value of those goods as yet unsold, the difference between the two sides of the account will then show gain or loss on the goods disposed of. The simplest way,

however, instead of subtracting in our books from either side of an account, is to add to the other side the amount we intend to subtract; hence we Cr. as per above rule all inventories of goods unsold.)

2. Close business accounts into loss and gain account. (The Dr. side of all business accounts shows outlay or loss; the Cr. side, returns or gains; and the difference between the two, the total loss or gain. As already explained, a loss and a gain account is a convenient place in the Ledger for arranging the losses and gains of the year under one head, to enable us to ascertain our net loss or gain. Closing business accounts into loss and gain account, therefore, is but carrying the Debit or Credit excess or balance forward from the account in which it occurs to a general loss and gain account. Closing an account is entering on its smaller side the amount necessary to make that side equal to the larger.)

3. Close loss and gain account into proprietor. (Our losses or gains taken from or added to our original investment give undoubtedly our present capital; therefore it is quite proper to carry the result of loss and gain account into proprietor account, gain being credited as an additional investment, loss debited as a withdrawal of capital.)

4. Balance proprietor and other financial accounts. (We close proprietor account to ascertain and exhibit our net present worth, and the financial accounts for convenience, as will be seen in the next paragraph.)

To commence a new year's business, the books just closed must be reopened; that is, all accounts showing the condition of our affairs — in other words, all accounts exhibiting assets or liabilities at the close of the old year — should, at the beginning of the new year, likewise indicate the same: hence the balance of financial accounts and the inventories of business accounts should be brought forward on the side opposite to that in which they appear in closing.

If these accounts have been accurately reopened, a Trial Balance will show the sum of the Debits to be equal to the sum of the Credits.

REMARKS ON THE DOUBLE ENTRY SET.

Journal. — A careful examination of the form presented, together with the explanations, will make this book perfectly clear. It is but necessary to add that the column to the left contains the Ledger page on which each account can be found; and the figures in the middle of the line, separating the entries, the day of the month.

Ledger. — This book does not differ much in form from that employed in Single Entry. In the third column of each side we write the name of the opposite account entering into the transaction; or in case there are several, the word "Sundries." In the next narrow column is placed the page of the Journal from which each entry is taken.

We must call particular attention to the ruling after the Ledger is closed. This serves to divide one part of the account from the other, and by its means we avoid the necessity of continually adding in figures which are no longer of any use.

The diagonal ruling in the third or opposite account column is used where the number of items on one side is much less than the number of those on the other, and serves to prevent the introduction of any items after the account has been closed.

The Trial Balance and the two forms of Balance Sheet need no further explanations than those already given. The Index to the Ledger will be of the same form exactly as in Single Entry.

For practice in Double Entry, the two Single Entry sets may be used, and the same results will of course be obtained, though by a different method.

TRANSACTIONS.

HARTFORD, CONN., June 1, 1882. I commence business this day with the following capital: —		
Resources.		
Cash,	$450 00	
James Owen's note @ 60 days, dated April 15,	250 00	$700 00
Liabilities.		
I owe my note @ 60 days, dated March 20,		$200 00
June 2. I buy of Andrew Simons on %.,		
2 doz. silk scarfs, @ $9 per doz.,	$18 00	
5 " collars, @ $1.20 "	6 00	
3 " suspenders, @ $4 20 "	12 60	
5 " shirts, @ $15 "	75 00	111 60
June 2. Bought for cash of Hartley & Wolf,		
1 case, 50 pieces, 2,200 yards prints, @ 10c. per yard,		220 00
June 2. Bought of Wm. Barton on %.,		
1 doz. cotton umbrellas, @ $2 25 each,	$27 00	
6 pairs toilet slippers, @ $1.20 each,	7 20	34 20
June 3. Sold for cash,		
½ doz silk scarfs, @ 90c. each,	$2 70	
¼ " suspenders, @ 50c. "	1 50	
½ " shirts, @ $1.50 "	9 00	13 20
June 4. Bought of Geo. A. Romer on %.,		
3 doz. bottles eau de Cologne, @ 50c.,	$18 00	
3 doz. tooth brushes, @ $12,	3 60	
20 " lead pencils, @ 40c.,	8 00	29 60
June 6. Sold Robert Dennis on %.,		
½ doz. tooth brushes, @ 15c.,	$0 90	
¼ " cotton umbrellas, @ $3,	9 00	
¾ " silk scarfs, @ 90c.,	8 10	18 00
June 7. Sold for cash,		
100 yards prints, @ 12c.,	$12 00	
½ doz. cotton umbrellas, @ $3,	18 00	
2 prs. toilet slippers, @ $1.50,	3 00	33 00
June 8. Sold Wm. Hammond for his note @ 60 days,		
½ doz. bottles eau de Cologne, @ 60c.,	$3 60	
1 doz. lead pencils,	40	
1 " collars, @ 15c.,	1 80	
½ " shirts, @ $18 per doz.,	9 00	
200 yards prints, @ 12c.,	24 00	38 80

June 10. Paid in cash,		
Expressage and cartage bill rendered to-day,	$5 40	
Rent for store, one month,	10 00	$15 40
June 10. Paid Andrew Simons,		
My note @ 30 days, for	$100 00	
Balance of his %. in cash,	11 60	111 60
June 12. Shipped to Geo. Bancroft, Chicago, to be sold on my %. and risk,		
1 doz. silk scarfs, @ 90c.,	$10 80	
3 " collars at 15c.,	5 40	
5 " shirts, @ $18 per doz.,	90 00	106 20
Paid freight and cartage on this lot,		3 80
June 14. Sold John Warren on %.,		
1 doz. shirts,	$18 00	
100 yards prints, @ 12c.,	12 00	30 00
June 15. Sold for cash,		
2 pairs toilet slippers, @ $1.50,	$3 00	
¼ doz. cotton umbrellas, @ $3,	9 00	
2 pairs slippers, @ $1.50,	3 00	15 00
June 16. Paid Geo. A. Romer on %.,		15 00
June 17. Gave William Barton a draft on Robt. Dennis for		18 00
June 19. Sold John Warren,		
100 yards prints, @ $12,	$12 00	
1 doz. shirts,	18 00	
1 " suspenders, @ 50c.,	6 00	36 00
June 19. Paid Romer's draft on me for balance of his %.,		14 60
June 20. Received an account of sales from Geo. Bancroft, Chicago, showing net proceeds from sale of my shipment of 12th inst, $121, for which he sends me a sight draft on the Merchants' National Bank of this city.		
June 21. Sold Robert Dennis, on %.,		
½ doz. bottles eau de Cologne, @ 60c.	$3 60	
1½ doz. tooth brushes, @ 15c.,	2 70	
3 " lead pencils, @ 50c.,	1 50	7 80
June 21. James Owen pays his note for $250 this day, as follows: —		
Cash,	$150 00	
New note, my favor, for balance @ 30 days,	100 00	250 00
June 22. Pay my 60 days' note for $200 by giving		
Hammond's note, my favor, for	$38 80	
Cash,	161 20	200 00

June 22. Received from Andrew Simons, Boston, to be sold for their acct. and risk,

6 doz. boxes fancy stationery, invoice @ 80c. each, $57 60

Paid freight and cartage thereon, 2 40

June 23. Sold John Warren on ℀., from Simons's consignment,

½ doz. boxes stationery, @ $1, 6 00

June 23. Received from John Warren his sight draft on Wm. Barton, for $40 on account.

June 24. William Barton draws on me for balance of ℀. @ 30 days' sight, which draft I accept, $16.20.

June 26. Sold for cash to W. B. Young, from Simons's consignment,

½ doz. boxes stationery, @ $1.15, $6 90

From my own stock,

¾ doz. slippers, @ $1.50, 13 50 20 40

June 27. Sold Robert Dennis on ℀., from Simons's consignment,

2 doz. boxes stationery, @ $1.10, $26 40

June 28. John Warren having become insolvent, agrees to pay 25% of his debts in cash and 25% in a note. Having accepted the compromise, I receive payment accordingly.

June 29. Sold for cash to W. B. Young, from Simons's consignment,

2 doz. boxes stationery, @ $1.15, 27 60

June 30. Closed Simons's consignment by rendering an account of sales, charging therein 5% commission, $3.35. Net proceeds due Simons, $61.15, with which I credit him.

By taking an inventory of merchandise on hand, we find it amounts to $230.55.

JOURNAL.

THURSDAY, JUNE 1, 1882.

				Dr.		*Cr.*	
3	Cash,	Amount invested,		$450	00	$	
2	Bills receivable,	Owen, April 15, 60 days,		250	00		
1	Proprietor,	For investment,				700	00
		1					
1	Proprietor,	Liability,		200	00		
2	Bills payable,	March 20, 60 days,				200	00
		2					
		2 doz. scarfs, @ $9,	$18 00				
3	Mdse.,	5 " collars, @ 1.20,	6 00				
		3 " suspenders, @ $4.20,	12 60				
		5 " shirts, @ $15,	75 00				
				111	60		
1	Andrew Simons on %.,					111	60
		2					
3	Mdse.,	2,200 yds. prints, @ 10c.,		220	00		
3	Cash,	Hartley & Wolf,				220	00
		2					
3	Mdse.,	1 doz. cotton umbrellas, @ $2.25,	$27 00				
		6 prs. slippers @ $1.20	7 20				
				34	20		
2	William Barton on %.,					34	20
		3					
3	Cash,					13	20
		$\frac{1}{4}$ doz. scarfs, @ 90c.,	$2 70				
3	Mdse.,	$\frac{1}{4}$ " suspenders, @ 50c.,	1 50				
		$\frac{1}{2}$ " shirts, @ $1.50,	9 00				
				13	20		
		4					
		3 doz. cologne, @ 50c.,	$18 00				
3	Mdse.,	3 " tooth brushes, @ $1.20,	3 60				
		20 " pencils, @ 40c.,	8 00				
				29	60		
1	George H. Roner on %.,					29	60
		6					
2	Robert Dennis on %.,			18	00		
		$\frac{1}{2}$ doz. brushes, @ 15c.,	$ 90				
3	Mdse.,	$\frac{1}{4}$ " umbrellas, @ $3,	9 00				
		$\frac{3}{4}$ " scarfs, @ 90c.,	8 10			18	00

2 JOURNAL.

	Wednesday, June 7, 1882.		*Dr.*		*Cr.*	
3	Cash,		$33	00	$	
	100 yds. prints, @ 12c.,	$12 00				
3	Mdse., ½ doz. umbrellas, @ $3,	18 00				
	2 prs. slippers, @ $1.50,	3 00			33	00
	8					
2	Bills receivable, William Hammond, 60 days,		38	80		
	½ doz. cologne, @ 60c.,	$3 60				
	1 " pencils, @ 40c.,	40				
3	Mdse., 1 " collars, @ 15c.,	1 80				
	½ " shirts, @ $1.50,	9 00				
	200 yds. prints, @ 12c.,	24 00			38	80
	10					
1	Andrew Simons, in full of %.,		111	60		
2	Bills payable, 30 days,				100	00
3	Cash balance,				11	60
	11					
4	Expense, express and cartage bill,		15	40		
3	Cash, and rent for one month,				15	40
	12					
4	Chicago shpt., George Bancroft, for my %.,		110	00		
	1 doz. scarfs, @ 90c.,	$10 80				
3	Mdse., 3 " collars, @ 15c.,	5 40				
	5 " shirts, @ 18c.,	90 00			106	20
3	Cash, freight and cartage on above,				3	80
	14					
1	John Warren, on %.,		30	00		
3	Mdse., 1 doz. shirts, @ $18,	$18 00				
	100 yrds. prints, @ 12,	12 00			30	00
	15					
3	Cash,		15	00		
	2 prs. slippers, @ $1.50,	$3 00				
3	Mdse., ¼ doz. umbrellas, @ $3,	9 00				
	2 prs. slippers, @ $1.50,	3 00			15	00
	16					
1	George A. Romer, on %.,		15	00		
3	Cash,				15	00

JOURNAL. 3

	SATURDAY, JUNE 17, 1882.		*Dr.*		*Cr.*	
2	William Barton, on %.,		$18	00	$	
2	Robert Dennis, draft favor Barton,				18	00
	19					
1	John Warren, on %.,		36	00		
	100 yds. prints, @ 12c.,	$12 00				
3	Mdse., 1 doz. shirts, @ $1.50.,	18 00				
	1 " susp., @ 50c.,	6 00				
					36	00
	19					
1	G. A. Romer, Balance of %.,		14	60		
3	Cash, Paid draft on me,				14	60
	20					
3	Cash, Draft on Merch. Nat. Bk.,		121	00		
4	Chicago shpt., net proceeds,				121	00
	21					
2	Robert Dennis, on %.,		7	80		
	½ doz. cologne, @ 60c.,	=$3 60				
3	Mdse., 1½ " brushes, @ 15c.,	2 70				
	3 " pencils, @ 50c.,	1 50				
					7	80
	21					
3	Cash, James Owen,		150	00		
2	Bills receivable, Owen, 30 days,		100	00		
2	Bills receivable, Owen, 60 days,				250	00
	22					
2	Bills payable, 60 days, March 20,		200	00		
2	Bills receivable, Hammond's, 60 days,				38	80
3	Cash balance,				161	20
	22					
4	Simons's const., 6 doz. stationery,		2	40		
3	Cash, freight and cartage,				2	40

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JOURNAL.

		FRIDAY, JUNE 23, 1882.	*Dr.*		*Cr.*	
1	John Warren, on %.,		$6	00	$	
4	Simons's const., ½ doz. stationery, @ $1.				6	00
	23					
3	Cash,	Sight draft on Barton,	40	00		
1	John Warren, on %.,				40	00
	24					
2	William Barton,	Balance of %.,	16	20		
2	Bills payable,	Accepted draft 30 days,			16	20
	26					
3	Cash,	W. B. Young,	20	40		
3	Mdse.,	¾ doz. slippers, @ $1.50,			13	50
4	Simons's const.,	½ " boxes stat., @ $1.15,			6	90
	27					
2	R. Dennis, on %.,		26	40		
4	Simons's const.,	2 doz. boxes, @ $1.15,			26	40
	28					
3	Cash,	25% of claim,	8	00		
2	Bills receivable,	do.,	8	00		
4	Loss and gain,	My loss,	16	00		
1	John Warren,	Settlement,			32	00
	29					
3	Cash,	W. B. Young,	27	60		
4	Simons's const.,	2 doz. boxes stat., @ $1.15,			27	60
	30					
4	Simons's const.,	as per %. sales,	64	50		
4	Expense,	Commission,			3	35
1	Andrew Simons,	Net proceeds,			61	15

LEDGER. 1

Dr. Proprietor. *Cr.*

1882.						1882.					
June	1,	Bills payable,	1	$200	00	June	1,	Sundries,	1	$700	00
"	30,	Balance,		629	60	"	30,	Loss and gain,		129	60
				$829	60					$829	60
						July	1,	Balance,		$629	60

Dr. John Warren. *Cr.*

1882.						1882.					
June	14,	Merchandise,	2	$30	00	June	23,	Cash,	4	$40	00
"	19,	"	3	36	00	"	28,	Sundries,	4	32	00
"	23,	Simons's cons.,	4	6	00						
				$72	00					$72	00

Dr. George A. Romer. *Cr.*

1882.						1882.					
June	16,	Cash,	2	$15	00	June	4,	Merchandise.	1	$29	60
"	19,	"	3	14	60						
				$29	60					$29	60

Dr. Andrew Simons. *Cr.*

1882.						1882.					
June	10,	Sundries,	2	$111	60	June	2,	Merchandise,	1	$111	60
"	30,	Balance,		61	15	"	30,	Simons's cons.,	4	61	15
				$172	75					$172	75
						July	1,	Balance,		$61	15

2

LEDGER.

Dr. WILLIAM BARTON. *Cr.*

1882.						1882.					
June	17,	R. Dennis,	3	$18	00	June	2,	Merchandise,	1	$34	20
"	24,	Bills payable,	4	16	20						
				$34	20					$34	20

Dr. ROBERT DENNIS. *Cr.*

1882.						1882.					
June	6,	Merchandise,	1	$18	00	June	17,	W. Barton,	3	$18	00
"	21,	Merchandise,	3	7	80	"	30,	Balance,		34	20
"	27,	Consignment,	4	26	40						
				$52	20					$52	20
July	1,	Balance,		$34	20						

Dr. BILLS RECEIVABLE. *Cr.*

1882.						1882.					
June	1,	Stock,	1	$250	00	June	21,	Sundries,	3	$250	00
"	8,	Merchandise,	2	38	80	"	22,	Bills payable,	3	38	80
"	21,	Bills rec'ble,	3	100	00	"	30,	Balance,		108	00
"	28,	John Warren,	4	8	00						
				$396	80					$396	80
July	1,	Balance,		$108	00						

Dr. BILLS PAYABLE. *Cr.*

1882.						1882.					
June	22,	Sundries,	3	$200	00	June	1,	Stock,	1	$200	00
"	30,	Balance,		116	20	"	10,	A. Simons,	2	100	00
						"	24,	W. Barton,	4	16	20
				$316	20					$316	20
						July	1,	Balance,		$116	02

LEDGER.

3

Dr. CASH. *Cr.*

1882.						1882.					
June	1,	Proprietor,	1	$450	00	June	2,	Merchandise,	1	$220	00
"	3,	Merchandise,	1	13	20	"	10,	A. Simons,	2	11	60
"	7,	Merchandise,	2	33	00	"	11,	Expense,	2	15	40
"	15,	Merchandise,	2	15	00	"	12,	Shipment,	2	3	80
"	20,	Chicago ship't,	3	121	00	"	16,	Cash,	2	15	00
"	21,	Bills rec'ble,	3	150	00	"	19,	Romer,	3	14	60
"	23,	John Warren,	4	40	00	"	22,	Bills payable,	3	161	20
"	26,	Sundries,	4	20	40	"	22,	Simons's cons.,	3	2	40
"	28,	John Warren,	4	8	00	"	30,	Balance,		434	20
"	29,	Simons's cons.,	4	27	60						
				$878	20					$878	20
July	1,	Balance,		$434	20						

Dr. MERCHANDISE. *Cr.*

1882.						1882.					
June	2,	A. Simons,	1	$111	60	June	3,	Merchandise,	1	$13	20
"	2,	Cash,	1	220	00	"	6,	Robt. Dennis,	1	18	00
"	2,	Wm. Barton,	1	34	20	"	7,	Cash,	2	33	00
"	4,	G. A. Romer,	1	29	60	"	8,	Bills rec'ble,	2	38	80
"	30,	Loss and Gain,		146	65	"	12,	Boston ship't,	2	106	20
						"	14,	John Warren,	2	30	00
						"	15,	Cash,	2	15	00
						"	19,	John Warren,	3	36	00
						"	20,	Robt. Dennis,	3	7	80
						"	26,	Cash,	4	13	50
						"	30,	Inventory,		230	55
				$542	05					$542	05
July	1,	Balance,		$230	55						

4 LEDGER.

Dr. EXPENSE. *Cr.*

1882.						1882.					
June	11,	Cash,	2	$15	40	June	30,	Simons's cons.,	4	$3	35
						"	30,	Loss and gain,		12	05
				$15	40					$15	40

Dr. SIMONS'S CONSIGNMENT. *Cr.*

1882.						1882.					
June	22,	Cash,	3	$2	40	June	23,	J. Warren,	4	$6	00
"	30,	Sundries,	4	64	50	"	26,	Cash,	4	6	90
						"	27,	R. Dennis,	4	26	40
						"	29,	Cash,	4	27	60
				$66	90					$66	90

Dr. CHICAGO SHIPMENT. *Cr.*

1882.						1882.					
June	12,	Sundries,	2	$110	00	June	20,	Cash,	3	$121	00
"	30,	Loss and gain,		11	00						
				$121	00					$121	00

Dr. LOSS AND GAIN. *Cr.*

1882.						1882.					
June	28,	J. Warren,	4	$16	00	June	30,	Merchandise,		$146	65
"	30,	Expense,		12	05	"	30,	Chicago shipt.,		11	00
"	30,	Proprietor,		129	60						
				$157	65					$157	65

TRIAL BALANCE.

Dr. *Cr.*

Balances.		Amounts.			L.F.	Amounts.		Balances.	
		$200	00	Proprietor,	1	$700	00	$500	00
		111	60	Andrew Simons,	1	172	75	61	15
$34	20	52	20	Robert Dennis,	2	18	00		
108	00	396	80	Bills receivable,	2	288	80		
		200	00	Bills payable,	2	316	20	116	20
434	20	878	20	Cash,	3	444	00		
83	90	395	40	Merchandise,	3	311	50		
12	05	15	40	Expense,	4	3	35		
		110	00	Chicago,	4	121	00	11	00
16	00	16	00	Loss and gain,	4				
$688	35	$2,375	60			$2,375	60	$688	35

STATEMENT.

1. Losses and Gains.

			Losses.	Gains.
Merchandise. —	Proceeds from sales,	$311 50		
	Value of unsold,	230 55		
	Total proceeds,	$542 05		
	Cost,	395 40		
	Net proceeds or gain,	$146 65		$146 65
Expense. — Outlay, or loss,			$12 05	
Chicago shipment. —	Total proceeds,	$121 00		
	" cost,	110 00		
	Net proceeds, or gain,	$11 00		$11 00
Loss and gain:	Loss,		16 00	
	Difference, or net gain,		129 60	
			$157 65	$157 65

2. Resources and Liabilities.

			Resources.	Liabilities.
1. From inventories.				
Merchandise. —	Unsold,		$230 55	
2. From ledger accounts.				
A. Simons.	I owe him,			$61 15
Robert Dennis.	Owes me,		34 20	
Bills receivable.	Notes on hand,		108 00	
Bills payable.	My notes outstanding,			116 20
Cash.	Balance on hand,		434 20	
Proprietor.	Investment,	$500 00		
	Net gain,	129 60		
	Present worth,	$629 60		629 60
			$806 95	$806 95

BALANCE SHEET.

Ledger Titles.	Trial Balance.		Inventory.	Business Statement.		Proprietor.		Financial Statement.	
	Dr.	Cr.		Losses.	Gains.	Dr.	Cr.	Resources.	Liabilities.
Proprietor,		$500 00					$500 00		
A. Simons,		61 15							$61 15
R. Dennis,	$34 20							$34 20	
Bills receivable,	108 00							108 00	
Bills payable,		116 20							116 20
Cash,	434 20							434 20	
Merchandise,	83 90		$230 55		$146 65			230 55	
Expense,	12 05			$12 05					
Chicago shipment,		11 00			$11 00				
Loss and gain,	16 00			16 00					
	$688 35	$688 35	$230 55						
Net gain to proprietor,				129 60			129 60		
				$157 65	$157 65				
To balance, net capital,						$629 60			629 60
						$629 60	$629 60	$806 95	$806 95

SECONDARY OR SUBSIDIARY BOOKS.

Thus far we have discussed the *essential* features of Double Entry book-keeping. We now come to a series of books which, though not absolutely necessary, are frequently very serviceable. The most of them may be employed in connection with either system of book-keeping, and can be modified to suit the circumstances.

Many other forms of books are used in business, but as they are mostly the result of a particular, rather than a general necessity, we cannot introduce them in this brief treatise.

Cash Book. — What we have already said in Single Entry, with reference to this book and its importance, is especially true in Double Entry book-keeping. It is but necessary to add to the practical instruction before given, that the items entered in the Cash Book may, if desired, be posted direct without being passed through the Journal. When the transaction is of a mixed character, that portion relating to Cash may be entered in the Cash Book, the remainder in the Journal.

As the entries on the Debit side of the Cash Book all involve a Debit to Cash account, and those in the Credit side all a Credit to Cash account, it is only necessary to carry the footings of each side forward from page to page, and post to Cash account in the Ledger once a month, the total Debits and total Credits for that time.

Petty Cash Book. — Payments in large houses being now mostly effected by means of checks, but little actual money is handled, and then only in small quantities. Whenever such is the case, it is found convenient to keep a separate account with the actual money handled, and the book in which this is done is the Petty Cash Book.

The amounts entered in this book are carried into the Cash Book proper, at stated intervals, say at the end of every day, week, or month; or they may be posted direct.

Bill Book. — This book has been fully explained and illustrated in Single Entry.

Sales Book or Blotter. — The general form of this book has already been presented in Single Entry. The entries are transferred to the Journal and then posted; or simpler still, are posted direct. As the Sales Book contains transactions which involve Cr. entries to merchandise only, it is but necessary to carry forward from page to page the total amounts of sales, and at the end of the month make one Credit to merchandise for the whole amount.

Purchase Book. — This is in form much similar to the Sales Book. In it are entered all purchases of merchandise. These entries may be Journalized and then posted; or they may be posted direct from the Purchase Book. In the latter case, as all the entries involve a Debit to merchandise, by carrying the amount of our purchases forward from page to page we need Dr. merchandise account but once a month.

Invoice Book. — As its name implies, this is a book in which copies of invoices received and rendered are kept. As the same person generally both receives and sends out invoices, it is well to keep the two classes distinct, which is effected by having an *Invoice Inward* and an *Invoice Outward* book; the latter consisting of press copies (the former being a scrap-book) of the actual invoices received, arranged in proper order.

Receipt Book. — This is a book in which receipts for money paid are usually taken, many business men preferring this form of receipt to receipted bills. Other books of this nature are Express Receipt Books (usually furnished by the express company), General Merchandise Receipt Book, etc., etc.

Bills of Lading, Accounts Current, Accounts Sale, and Statement Books are fully explained by their names.

Columnar Journal. — To obtain most of the advantages which result from the use of the above-named auxiliary books, they are found practicable by having extra columns in the Journal for certain frequently recurring accounts; thus, if on the Dr. and Cr. side of the Journal we have a separate money column, into which extensions of merchandise can be carried, we can, bringing these forward from day to day, make one Dr. and one Cr. entry to merchandise at the end of the month to cover all the transactions. The remaining part of each entry can of course be posted immediately. Again, we may have a separate Dr. and Cr. money column for Cash, posting — as in the case of merchandise — only once a month. We give below a sample of a Columnar Journal combining the two classes just spoken of. This subdivision and use of additional money columns in the Journal can, of course, be carried on to any extent desired; thus, instead of simply one column for merchandise, we might have one for each of the following: Corn, wheat, rye, flour, etc.

	Dr.				*Cr.*	
Mdse.	Cash.	General.	Thursday, June 1, 1882.	General.	Cash.	Mdse.
	$1,000 00		Cash, check on Nat. Bk.			
		$620 00	Bills receivable, James Smith's note, @ 10 days.			
			Mdse., 200 bbls. flour, @ $8,			$1,600 00
			Expense storage, 1 month,	$20 00		
			— 2 —			
$5,000 00			Mdse., 1,000 bbls. flour, @ $5,			
		50 00	Insurance, 1% 3 months,			
			Cash, check on Corn Exchange Bank,		$1,000 00	
			Bills payable, my note @ 60 days,	3,000 00		
			James Smoker, on %.,	1,050 00		

INCIDENTAL SUBJECTS.

Banks and Banking. — We have elsewhere alluded to the banking system now prevalent in large communities. Let us here briefly examine its nature.

A bank is a collection of individuals into a society or corporation for the purpose of —

(1.) Receiving and preserving money in trust. (These moneys are called deposits.)

(2.) Delivering this money by order of the depositors to persons designated by them.

(3.) Lending money, for the use of which interest or discount is charged.

(4.) Issuing and circulating convenient forms of money (*e. g.*, bank notes) as per laws enacted by the general government.

Any one of these functions irrespective of the others (all of which are exercised by large banking institutions) may with advantage be carried on by private or corporate concerns. We will therefore rapidly glance at the origin and operation of each function.

(1.) The *Deposit Function.* — Money, to be secure from robbery, must be kept in some suitably protected and guarded box or chest. Strong boxes, called *safes*, are manufactured for this especial purpose, but being expensive, they may be beyond the means of many small dealers. Still, they are very essential, and should be purchased if possible.

If a person of well-known integrity can be found in a village or town, with sufficient capital to purchase a safe, he can at small expense keep the money of several dozen merchants, in fact of quite a large community; thus a village bank of deposit is duly organized and equipped.

(2.) The *Exchange Function.* — Jones, a depositor in the village bank, having to pay Smith, another depositor, $100, does so by drawing an order on the bank for that amount. Later in the day Smith pays Wilkins, a third depositor, also $100, by a similar order. Wilkins, owing Jones $100, can also wipe out his indebtedness by an order on the bank in Jones's favor. At the end of the day, each one's account at the bank is exactly the same as in the morning, yet each has received and paid $100, without handling or risking the loss of a single coin.

What is thus true of any single bank is equally true of all the banks in any town or city; for these at the close of the day usually exchange checks (as the orders above mentioned are called), banks having the smaller amounts in their favor paying the difference in money. In large cities, like New York and Boston, these settlements are made in a general office called the CLEARING HOUSE.

Again, if A, residing in Boston, sell B in New York $500 worth of shoes, instead of having B send him the money in payment by express (thus incurring the risk of loss and the expense of transportation), A can draw on B for the amount of his bill, the draft to be paid to the person whom A names.

Now if C, residing in New York, sell D in Boston $500 worth of potatoes, C likewise can draw on D for $500, making his draft payable to whom he pleases.

If A and C can now exchange their respective drafts on B and D, each will have a draft on a party in his own city. This exchange between strangers in different parts of a country is usually effected thus: The merchants of different cities, drawing drafts, etc., transfer them by sale to a bank in their city, and these banks, which are in constant correspondence with each other, exchange and collect them. In this manner the indebtedness of persons in each of two cities, to persons in the other, is exchanged at a cost of a few cents' postage and a few entries, and the frequent and expensive transmission of large sums of money obviated.

(3.) The *Discount Function.* — Actual experience has shown that about two thirds of a bank's deposits are forever lying in its vaults unused, or at least uncalled for. This, in connection with the original capital invested by the stockholders, gives the institution large sums of money, which it can profitably lend to those who have the desire and the necessary skill to carry on business operations, but who lack the ready capital. Hence, in consideration of a small percentage of discount, persons of known character can, upon proper security (real estate, indorsed notes, etc.), obtain from banks exercising this function loans of capital wherewith to carry on their business.

(4.) The *Circulating Function.* — In most countries of the globe, metallic currency has been established by the government. This is found, however, often cumbrous and inconvenient to handle; hence private individuals, banks, and governments themselves have from time to time issued written or printed promises to pay, upon presentation of the documents, current metallic money to the amount mentioned therein. When issued by an individual, these are called notes; by a bank, bank notes; by a government, paper currency (in this country, greenbacks). The advantages of properly secured paper currency over metallic currency are: —

1. It answers as well as metallic currency in effecting exchanges, and possesses less intrinsic value.
2. The wear and tear from use is smaller.
3. It is more easily counted, and more cheaply and more conveniently transported.
4. If stolen, it may be more easily identified (by being properly numbered).

The first advantage mentioned above will of course depend upon the faith placed in the party issuing the paper currency. In the case of an established government, there is generally no question as to the acceptance of its notes; individual notes, however, can never have the same security, and hence are limited in their circulation as a substitute for coin. Bank notes also will be more restricted in their circulation than the notes of the government, though more freely accepted than individual notes. In our own country, the national bank notes are now guaranteed by deposits of United States bonds made by these banks with the general government at Washington, in accordance with law, in other words, the government, in consideration of these securities, indorses the notes of our national banks. Moreover, as the entire management and direction of the business of such banks is subject to restrictions and regulations imposed by the national government, there need be no question as to the redemption or payment in specie of these bank notes.

Having explained now the nature and functions of banks, let us see how an account with one is opened and kept.

Having been accepted by the officers of the bank as a depositor, and written my signature in their books as a guide to the genuineness of my subsequent written communications with the bank, I prepare a slip, furnished by the institution, called the deposit slip or deposit check, and presenting this at the bank with the moneys as therein specified, I receive in return a small pass book (called in business the bank book). In this book, on the left or debit side, the bank enters all sums deposited by me, and on the right side all sums withdrawn. As before explained, withdrawals are made by filling out orders on the bank, called checks, either in favor of the bearer or to one's own order, or the order of a specified person. In the last two cases the check must be indorsed (that is, signed on the reverse side) by the person to whose order it is made out, before presentation for payment. For the convenience of depositors, the bank usually furnishes books containing blank forms for checks (as shown further on). In that case it is customary for the depositor to keep his account with the bank on the stubs (unused portion of the page remaining when the check is taken out), as shown. The reverse side of the stub immediately preceding is used for a record of the deposits; and on the face of the stub belonging to a number of checks, full particulars thereof are preserved.

By carrying the amounts forward from page to page, we can ascertain by simple subtraction, at any moment, what our balance in the bank is; in other words, how much the bank owes us. The blank spaces in checks should be filled by a stroke of the pen to prevent what is termed "raising," a practice frequently resorted to by dishonest persons. An altered check is one in which the amount is taken out by chemicals, or otherwise, and any required amount substituted. In the payment of forged checks, the bank assumes all the responsibility, and cannot recover from the person whose name is forged. When requested to do so, a bank will testify on our checks, in writing, that they will be honored on presentation for payment. This is called *certifying* the check.

At the end of the month the depositor sends his book to the bank to be written up and balanced; *i. e.*, to have the amounts withdrawn placed on the credit side and the balance inserted. When this is done, the book is returned, together with the checks or notes paid by the bank during that time, and called by them "returned vouchers"; they are the vouchers or sureties that the bank has paid out these amounts for the depositor's account.

Before leaving the subject of "bank accounts," a word as to the manner in which we can keep the record in our books. Some prefer to treat their bank account simply as a portion of the cash, on the basis that their deposits are convertible into cash almost as readily as though they were in their own safes. The records in the check book and bank book are depended upon for information as to the balance in bank.

Another method is to open an account in the Ledger with the bank, crediting it for all deposits, and debiting for all checks given. The stub record, though not absolutely necessary, might be kept as an additional safeguard.

DEPOSIT SLIP.

Boston, Aug. 1, 1882.

Deposited by John Baumeister

IN

NATIONAL BANK OF BOSTON.

Bills,	$50	00
Specie,	100	00
Checks, — Law. Brown,	50	00
Jas. Drewes,	25	00
	$225	00

Dr.		*National Bank of Boston,*					*in a/c with J. Baumeister.*		*Cr.*
Aug.	1,	Deposit,	$225	00	Aug.	31,	Check,	$100	00
"	15,	"	100	00			"	50	00
"	30,	"	150	00			"	200	00
"	31,	"	200	00			"	190	00
							Balance,	135	00
			$675	00				$675	00
Aug.	31,	Balance,	$135	00					

4 vouchers returned.

Aug.	1,	Deposit,	$225	00
"	15,	"	100	00
"	30,	"	150	00
"	31,	"	200	00
			$675	00
		Checks,	540	00
		Balance,	$135	00

No. 1. Aug. 1. Bearer, Rent.	$100	00
No. 2. Aug. 15. Jas. E. Munson, Services.	$50	00
No. 3. Aug. 15 Myself.	$200	00
No 4. Aug. 30. Jno. C. Smith & Co.	$190	00
No. 5.		

No. 1. Boston, Aug. 1, 1882.

National Bank of Boston,

Pay to Bearer, ... or Order,

One hundred .... $\frac{00}{100}$ Dollars.

$\$100\frac{00}{100}$. John Baumeister.

No. 2. Boston, Aug. 15, 1882.

National Bank of Boston,

Pay to James E. Munson, ... or Order,

Fifty .... $\frac{00}{100}$ Dollars.

$\$50\frac{00}{100}$. John Baumeister.

No. 3. Boston, Aug. 15, 1882.

National Bank of Boston,

Pay to Myself .... or Order,

Two hundred .... $\frac{00}{100}$ Dollars.

$\$200\frac{00}{100}$. John Baumeister.

No 4. Boston, Aug. 30, 1882.

National Bank of Boston,

Pay to John C. Smith & Co., ... or Order,

One hundred and ninety .... $\frac{00}{100}$ Dollars.

$\$190\frac{00}{100}$. John Baumeister.

No. 5. Boston, ..., 188 .

National Bank of Boston,

Pay to .... or Order,

.... $\frac{}{100}$ Dollars.

$........................ ....

Consignments. — We may frequently receive goods to sell for another on commission. Such a parcel of goods we call a consignment, and with it we receive a document called an invoice, enumerating the articles sent and giving their cost value, as a basis for our sales. As we are acting for another in the capacity of agent, it is proper, and generally agreed upon, that the shipper should pay all charges incurred by us in handling and disposing of his goods.

That we may keep an accurate record of these expenses, as well as of the sales or disposals of the goods, we open an account in the Ledger, calling it, for example, Jones's Consignment. This account should be debited for all expenses incurred, and credited for all sales made. When we have sold all the goods, we should debit for our commission, and then the excess of the Cr. side over the Dr. will be the net proceeds or amount due Jones. This amount we should remit to Jones, or place it to the credit side of his personal account in our Ledger, leaving the remittance or settlement for some future time. To convey complete intelligence of all our transactions to the principal (party for whom we act as agents), a document called the Account Sales should be made out and sent to him.

Shipments. — In the course of our business we may ship to some one else a lot of merchandise to be sold for us on commission. This we call a shipment; and to ascertain whether it is profitable or not, we keep a Ledger account with it, calling it, for example, Shipment to Chicago. This account — somewhat like a simple merchandise account — should be debited for the original cost of the goods we ship, and for any charges incurred by us in handling. When we receive the Account Sales from our agent (to whom this is a consignment, and on whose books this will be treated exactly as described in the preceding paragraph), we credit the shipment account with net proceeds received or due us, and the difference between the two sides of the account will show loss or gain.

Private Ledger. — In large commercial establishments, the book-keeper, for various reasons, is often kept in ignorance of the actual division of the firm's capital among the individual members, though his proprietor account tells him accurately what the total worth is. When such is the case, a private Ledger is usually kept by one of the members of the firm, or by a confidential clerk. In this, an accurate record of the division of the capital, and sometimes an account of the private affairs of the several partners, is kept. To preserve its secrecy more effectually, the book is sometimes provided with a lock, the key to which is carried by one of the firm.

Cash Tickler. — This is a book containing, properly classified under the dates of the month, a record of what bills, notes, or other moneys we are to pay or receive. From it we can easily make our financial calculations, and arrange to meet all our obligations promptly, thus adding much to our reputation for stability.

Partnerships. — When two or more people engage in business together, it is customary to draw up a written agreement or articles of copartnership, accurately describing each one's share of the capital invested, his duties and privileges as a member of the firm, and how much his share of the loss or gain is to be. For instance, in consideration of the profits being divided equally, one partner may invest the money, another the industry, or talent for carrying on the business. In fact, all possible combinations of capital with capital, industry with industry, and capital with industry, can be found in business communities.

The books of a partnership business need differ from those of a single proprietor in but one particular, — viz., the proprietor account, which may be split up into a number of accounts, one for each of the partners; but this is not absolutely necessary, for a simple proprietor account, or an account of the whole capital of the business may be opened, the partners themselves keeping in the private Ledger their own records of individual investments.

Double Entry and the Retailer. — Double Entry book-keeping has been claimed by many to be ill suited to the retail dealer's business. The only real objection offered is the difficulty of keeping an accurate account of the sales of merchandise, as these are necessarily made in such small quantities. But this objection is easily disposed of. The retailer, selling mainly for cash, by keeping his returns from merchandise in a drawer, separate from other receipts, and taking especial care against the removal of money during the day (or, if compelled to pay out any of it, by replacing the amount by a slip or voucher), can, at the end of the day, tell exactly how much the day's sales were. Sales made on credit can of course be easily ascertained; for no one with the slightest pretensions to method will ever fail to record these, in some form or other, immediately.

If the above method, which is thoroughly practical and serviceable, be found inconvenient, it will be well (and this method is used by some of the largest retail concerns of the country), when a sale is made, to prepare a small slip of paper, upon which can be stated its amount and such other details as time will permit. These slips, properly numbered to insure none being lost (this numbering can be easily done in unoccupied moments), will at the close of the day afford an accurate account of what has been done.

The numerous small amounts of cash paid out by the retailer have been also urged against the possibility of his keeping books by Double Entry; but when we remember that as the business increases in size, these petty outlays increase in number, we must certainly admit that it is no more difficult to keep the record thereof in retail business than in wholesale, for which latter all allow Double Entry book-keeping to be the better system.

Qualities of a Book-keeper.—The qualities most sought for in a book-keeper are: 1. Accuracy; 2. Neatness; 3. Rapidity; and in the order named. They should be aimed at by every one engaged in book-keeping.

1. Accuracy, without which books are useless, is best obtained by a thorough system of checking; as for instance, in large firms long accounts can be ticked off to where they balance. "Always look before you leap" is a good motto for a book-keeper. Pen should never be placed on a book until you are thoroughly sure you have the right place, the right word, the right figure. After an entry is made, it should be carefully examined before another is taken up. If everything is correct as we progress, the final result will and must be correct.

2. Neatness is conducive to accuracy. It is secured only by great effort. Let your writing be not too large; let it be plain and unadorned ("beauty unadorned is at its best"). To make a word or figure perfectly distinct, it is not necessary to produce lines as wide as a cart-wheel. Erasures, besides destroying in court all confidence in one's books, always spoil the appearance of a page. In writing figures, be careful to place units under units, tens under tens, hundreds under hundreds, etc., or else much time and patience will be consumed in footing up the columns. Use good ink and good pens.

3. Rapidity is the third in order of the prominent qualifications of a book-keeper, and should never be indulged in at the expense of the other two. Study brevity in making entries, and use no unnecessary words. Abbreviate as much as possible consistent with legibility. Use the briefest possible style of writing, short roads being travelled quicker than those which are long. Be methodical in all things, and rapidity will result. Do but one thing at a time. Never get excited.

Much time may be saved in the mechanical work of writing up our books, by omitting in the Ledger the words Dr. and Cr. at the head of each account. In all the civilized countries of the world, the left side of an account is the Dr. and the right side the Cr., hence no uncertainty need result from the omission. For a similar reason, the words Dr. and Cr. may be omitted from the Journal columns.

Copying Letters.—It is very desirable to preserve copies of all letters we write to others—not only as a matter of record for our own use and convenience, but for their service in case of dispute or litigation—by a process called press copying. A special ink called copying ink must be used in writing. A sheet of tissue paper is placed on a blotter and moistened; the excess of water is then removed by means of another blotter, leaving the tissue paper barely moist; the writing to be copied is now placed face downward on the moistened tissue paper, the whole covered by a blotter, thrust into a screw press, and pressure applied. Upon removal from the press, an exact fac-simile of the document will be found on the tissue paper. This can be done with but little cost of time or money; a boy can thus, in one hour daily, do all the copying for quite a large business.

Another good habit for a business man is, never to destroy a bill, receipt, letter, or any other document, but to file away carefully and systematically everything of this nature received. At the end of the year, the documents which have accumulated in that interval can be placed in a properly constructed and labelled box; and thus though the business continue for many years, yet with but little trouble and a small loss of time any document desired can be brought to light. Frequently by having documents thus preserved, disputes at law have been finally and amicably settled, whereas otherwise long litigation and much unfriendly feeling would have resulted.

COMMERCIAL ABBREVIATIONS AND SIGNS.

@. At, to, per, for, each.
A 1. The designation of a first-class vessel in Lloyd's Register of British and foreign shipping; the letter denoting that the hull is well built and seaworthy, and the figure the efficient state of her rigging, anchors, cables, stores, etc. The figure 2 would imply that these were insufficient or of an inferior quality. Hence, A 1 is used in other connections to describe best quality.
Acct., %. Account.
A. D. (*anno Domini*). The year of our Lord.
Ad. V. (*ad valorem*). At or on the value.
Agt. Agent.
A. M. (*ante meridian*). Before noon.
Amt. Amount.
Ans. Answer.
Arr. Arrived.
Asstd. Assorted.
Atty. Attorney.
Avg. Average.
Bal. Balance.
B. B. Bill book.
Bbl. or brl. Barrel.
B/C. Bill for collection.
Bdls. Bundles.
B/E. Bill of exchange.
Bgs. Bags.
Bk. Bank.
Bkts. Baskets.
B/L. Bill of lading.
Bs/L Bills of lading.
Bls Bales.
Bot., b't. Bought.
B. O. and S. O. Buyer's Option, Seller's Option. By the rules of the produce business in the different parts of the country, various products are sold for future delivery; *i. e.*, delivery during some month yet to come, the particular day being left to the buyer or seller in accordance with the understanding between them. In the former case, the term "buyer's option" is employed; in the latter, "seller's option."
B. Pay. Bills payable.
Bque. Barque.
Br. Brig.
B. Rec. Bills receivable.
Bt. Boat.
Bu., bush. Bushels.
Bxs. Boxes.
¢. or c. Cents.
Cap., Capt. Capital.
Cash. Cashier.
C. B. Cash book.
C. C. (*compte courante*, French). Account current.
Chgd. Charged.
Chts. Chests.
C. I. F. (cost, insurance, freight). A commercial term to designate a price at which a shipper agrees to place goods in the hands of the transportation agents, with insurance and freight thereon fully prepaid.
C. & F. (cost and freight). Same as above except omission of insurance, which is in this case left to the buyer to effect if he wishes it.
Cks. Checks, casks.
Co. Company, county.
C/o. Care of (addressing envelopes, etc.).
C. O. D. Collect (or cash) on delivery.
Col. Column.
Com. Commission.
Consgt. Consignment.
Cor. Sec. Corresponding secretary.
Cr. Credit or creditor.
Cs. Cases.
Cwt. Hundred-weight.
D., d., or dol. Dollar.
D. B. Day-book.

Dep. Deposited.
Dept., dpt. Department.
Dft. Draft.
Dis., disct. Discount.
Div. Dividend.
Do. or " (ditto). The same.
Doz. Dozen.
Dr. Debit, debtor.
Dr. Sr. Dear Sir.
D's. Days.
D/S. Days after sight.
Dwt. Pennyweight.
Ea. Each.
E. E. Errors excepted.
E. & O. E. Errors and omissions excepted.
E. g. (*exempli gratia*). For example.
Eng. English.
Ent. Entered.
Etc. (*et cetera*). And so forth.
Ex. Example.
Ex., exp. Express.
Exch. Exchange.
Exp. Expenses.
Fav. Favor.
Figd. Figured.
Firs. Firkins.
F. O. For orders.
F. O. B. (Free on board). This is the term used when a seller guarantees, for a price named, to deliver goods into the hands of the proper transportation company free of all charge to the buyer for such delivery.
Fo., fol. Folio.
For'd., fwd. Forward.
Fcs. Francs (French money).
Frt. Freight.
Ft. Foot, feet.
G. G. Gross gauge, gross gallons.
Gal. Gallon.
Gr. Grain, gross.
Hf. Half.
Hf. chts. Half chests.
Hhd. Hogshead.
I. B. or Inv. B. Invoice book.
I. e. (*id est*). That is.
In. Inch, Inches.
Ins. Insurance.
Inst. (instant). Present month.
Int. Interest.
In trans. (*in transitu*). In transit, on the passage.

Inv. Invoice, inventory.
J. Journal.
Lbs. (*libra*, Latin). Pounds.
Led. Ledger.
L. F. Ledger folio.
M/a. Months after date.
Mdse. Merchandise.
Memo. Memorandum.
Mfr. Manufacturer.
Misc. Miscellaneous.
Mo., mon. Month.
MS., MSS. Manuscript, manuscripts.
N. B. (*nota bene*). Observe or note well, note book.
No. (*numero*). Number.
N. P. Notary public.
% Per cent.
O. K. (all correct). Correct.
Ovchg. Overcharge.
Oz. Ounce.
P., pp. Page, pages.
P. P. (*per pro*). For. Used by one possessing power of attorney; that is, the right to sign for another.
Pay't. Payment.
Pcs., ps. Pieces.
Pd. Paid.
Per. By the.
Per An. (*per annum*). By the year.
Per Cent. (*per centum*). By the hundred.
Pk., pks. Peck, pecks.
Pkgs. Packages.
Plts. Plates.
P. M. (*post meridian*). Afternoon.
P. O. Post-Office.
P. O. D. Post-Office department.
P. O. O. Post-Office order (money order).
Pop. Population.
P. P. S. Second postscript. (See P. S.)
Prem. Premium.
Pres. President.
Pro tem. (*pro tempore*). For the time being.
Prox. (*proximo*). The coming month.
P. S. (*postscriptum*). Postscript; that is, something written after the signature to a letter.
Pt., pts. Pint, pints.
P. T. O. Please turn over.

Pun. Puncheon.
P. & L. Profit and Loss.
Qr. Quarter, Quire.
Qt., qts. Quart, quarts.
Qy. or (?) Query. (Question)
Rec'd., Rec$^{\text{d}}$. Received.
Rec'd. Pay. Received payment.
Rec. Sec. Recording secretary.
Rec't. Receipt.
Resp'y. Respectfully.
Ret'd. Returned.
R. R. Railroad.
Sat. Saturday.
S. B. Sales book.
Sch., schr. Schooner.
Sec'y. Secretary.
Sh. Ship.
Shpt. Shipment.
Sine die. Without day or date.
Sld. Sailed.
S. S. Steamship.
Stg. Sterling.
Str. Steamer.
Sund. Sundries.
Supt. Superintendent.
T. O. Turn over.
Tonn. Tonnage.
Trcs. Tierces.
Treas. Treasurer.
Ult. (*ultimo*). Last, or of the last month.
U. S. M. United States mail.
Ves. Vessel.
Via. By way of.
Viz. (*videlicet*). Namely; to wit; as follows.
Vol. vols. Volume, volumes.
Vs. (*versus*). Against.
Wk. Week.
Whf. Wharf.
Wt. Weight.
Yd. Yard.
Yr. Year or your.
&c. And so forth.
✓ Check, or tick mark.
4to. Quarto, 4 leaves or 8 pages to a sheet.
8vo. Octavo, 8 leaves or 16 pages to a sheet.
12mo. Twelvemo, 12 leaves or 24 pages to a sheet.
16mo. Sixteenmo, 16 leaves or 32 pages to a sheet.
18mo. Eighteenmo, 18 leaves or 36 pages to a sheet.
24mo. Twenty-fourmo, 24 leaves or 48 pages to a sheet.

Mercantile Terms.

Here are given only a few business terms, as most of the more important ones are treated of incidentally and at greater length in the articles on "Law," "Book-keeping," "Business Advice," "Synonymes," or "Arithmetic," in this work. Some of the terms herein contained are also treated of more extensively elsewhere.

Abatement. — An allowance, deduction, or discount.

Acceptance. — The promise to pay a draft or bill of exchange; usually done by writing the word "Accepted," with the person's signature, across the face of the paper.

Account Current. — A running or continued account, or an exhibit of the same.

Adjustment. — The settlement or arrangement of an account, or a loss under an insurance policy.

Ad Valorem. — A duty laid on the value of imported goods, and differing in this respect from *specific* duties, which are levied on the measurement, quantity, or weight of goods.

Advance. — Profit, or money paid before the delivery of merchandise, or before the goods are sold by the factor; increase in value.

Advice. — Business information.

Agio. — Premium, or the difference in the value between foreign and domestic money.

Allowance. — An abatement or deduction for any reason.

Amount. — Sum total, aggregate.

Antedate. — To date before the present time.

Assets. — The entire property of all kinds belonging to a firm.

Assortment. — Variety in style, price, color, quality, etc.

Auction. — Public sale to the highest bidder.

Auditor. — A person selected to examine accounts.

Average. — Medium time assessment; fair specimen.

Balance. — The difference between the two sides of an account; to adjust or settle an account.

Ballast. — Any heavy material placed in the hold of a ship for the purpose of making it steady, and therefore used mostly when the cargo is light.

Bankable. — Funds receivable at the bank at face value.

Bankrupt. — An insolvent; a person unable to pay his debts in full.

Bank Stock. — The shares of capital invested in a bank; they are usually transferable.

Bargain. — A contract or agreement.

Bearer. — Carrier, holder, or person presenting a draft or order for payment.

Bills. — Commercial paper, bank notes, a full account, an itemized account.

Bills Payable. — Notes and drafts issued by a firm remaining unpaid.

Bills Receivable. — Notes and drafts received by a firm from its debtors which are unpaid.

Bond. — A certificate of contingent liability, as the liability for non-performance of a contract.

Bonded Warehouse. — A place where imported goods are stored until the duties are paid or the goods are reshipped.

Brand. — Usually a mark made by a hot iron; any mark indicating the quality, maker, etc.

Broker. — An agent for the sale and purchase of merchandise by sample, or of mercantile paper, or stocks.

Bullion. — Uncoined gold and silver, usually in bars.

Bulls and Bears. — These terms were originally used in the stock exchanges (buildings in large cities in which transactions in railroad stocks, bonds, etc., are carried on): a Bull being one who believes a certain kind of stock is going to rise in value, and acts upon that belief; a Bear, one who thinks that a certain stock will decline, and governs his actions accordingly. Hence, a Bull in the commercial world is one who endeavors to force prices upward; a Bear, one who tries to depress the market.

Call. — "The right to buy" in the broker's vernacular. (See **Put.**)

Capital. — Amount invested in business.

Cartage. — Conveyance of merchandise, or charge for the same.

Cash. — Money, or its equivalent, as sight drafts, checks, etc.

Cash Accounts. — Which can be immediately converted into money; items of receipts and disbursements.

Certificate. — A testimonial or voucher in writing, as a certificate of stock or deposit.

Certified Check. — Order or draft accepted by a bank for payment.

Charges. — Costs, expenses.

Check. — An order on a bank for the payment of money deposited by the drawer.

Clearance Papers. — A permit from the customs officials allowing a vessel to sail or clear from a port.

Coin. — Pieces of gold and silver bearing the government stamp, which makes them a legal tender.

Collateral. — Additional, and used in this sense when applied to security. (See Legal Department.)

Commerce. — The trade between different places and communities; extended traffic.

Commission. — A fee for transacting another person's business; allowance or per cent; authority granted.

Consignment. — Goods sent to an agent to be sold on account of sender.

Corporation. — An association specially authorized by law to do business under a certain name.

Coupon. — A dividend or interest check or order, usually annexed to bonds.

Custom. — Credit, usage, habit; the trade or patronage of an establishment; revenue duty on goods imported or exported.

Days of Grace. — The days allowed by law for the payment of negotiable paper after the time specified therein, — usually three days.

Demand. — A presentation of a bill for payment, or a request that certain things be done.

Discharge. — Dismiss, release, perform, dismission in bankruptcy; to unload the cargo of a vessel; by payment of debts or obligations.

Discount. — Abatement, allowance, or deduction; payments in advance for interest.

Dishonored. — A check is dishonored when a bank refuses to pay it; so with all mercantile paper on which payment is refused.

Dividend. — A proportional share of the whole amount, usually as interest.

Draw. — To call for money by draft; written demand for money deposited or due.

Drawback. — The amount paid back.

Drummer. — A travelling salesman, a solicitor of business.

Due Bill. — A written admission of debt, payable on demand.

Dun. — An oft-repeated demand for payment.

Duties. — Government taxes on imported goods.

Earnest. — Money or goods given to bind a bargain.

Effects. — Movable property, assets.

Entry. — A record of a business transaction in a firm's books, custom-house permission to enter and land cargo.

Exchange, or Mart. — A place where business men meet at certain hours to transact business. In large cities many master mechanics make the exchange their sole place of business, each member of the exchange having a separate box for the reception of letters and orders. Mechanics assemble at their exchanges about noon, which saves time, and greatly facilitates their dealings with each other.

The forwarding of money by draft, or the difference between foreign and domestic money, is also called exchange.

Export. — To send goods to a foreign country.

Extension. — Further time allowed for the payment of an obligation due, or becoming due.

Fail. — To be unable to pay liabilities in full.

Fair. — Honorable, reasonable; a grade above middling.

Firm. — A copartnership, a business concern.

Free Trade. — Commerce restricted by taxes or duties for revenue only, sufficient to meet the expenses of the government; or unrestricted by duties or tariff legislation.

Freight. — Cargo, lading; cost of transportation.

Good-Will. — The custom or trade attached to a business, or the probability that old customers will resort to the old stand.

Gross Weight. — The weight of goods, including cases, barrels, or boxes.

Guarantee. — A person to whom a guaranty is given.

Guarantor. — One who gives a guaranty.

Guaranty. — A promise to indemnify or save harmless, or to pay in the event of the debtor's inability.

Importer. — A dealer who causes goods to be brought from foreign lands.

Imports. — Merchandise brought to this country from abroad.

Income. — The total gains from business, labor, or property.

Instalment. — A part or portion of the whole.

Instant. — Present, current; as the 21st inst., or 21st of the present or current month.

Inventory. — A list of the property of a person or estate.

Invoice. — A bill of items of goods bought.

Jobber. — A wholesale dealer who sells to retailers.

Job Lot. — Usually odds and ends; unsalable goods marked down to sell readily, or to get rid of.

License. — Permission; legal authority to do a certain act or thing.

Line of Deposit. — The average balance of the amount deposited in the bank by a patron for a given time, usually one month.

Line of Discount. — The average amount borrowed by a dealer in a specified time through discount on notes and drafts, etc.

Loan. — To lend money or other valuable property temporarily, expecting to receive it back.

Long and Short. — When we sell of any kind of merchandise more than we have on hand or have bought, we are said to be short of the article. When we have on hand or have bought more than we have sold, we are said to be long of the same.

Mail. — To post letters; the letters, papers, etc., received daily; the mail transmitted by the government.

Manifest. — An official description of a vessel's cargo, a copy of which must be furnished to the customs authorities on its arrival in port.

Manufacture. — The process of reducing raw materials to a form fit for use.

Margin. — The difference in their favor which brokers exact between the market value of the security upon which they loan money and the amount of the loan.

Maturity. — The time for payment.

Mercantile. — Buying and selling of goods in market; commercial; pertaining to business.

Merchandise. — Wares, goods, commodities traded in by merchants.

Merchant. — One who buys and sells, especially on a large scale.

Mint. — A place where money is coined; unlimited supply; to coin a certain value.

Money. — Coin stamped by government, or its equivalent, as bank notes, etc., redeemable in coin.

Monopoly. — Exclusive command, or sole permission and power to trade or deal in or with.

Negotiable Paper. — That which can be transferred with all the rights of ownership, by indorsement.

Net. — No discount; actual weight; clear of all charges or deductions.

Notary. — A person appointed by the State to receive acknowledgments of certain civil acts, as the making of a will, deed, affidavit, etc., and to attest the same under his seal, which is recognized and admitted as evidence in all the courts of the civilized world, — hence the term notary public; commercially, to protest notes and drafts for non-payment.

Open Account. — Continuous, running, unpaid account.

Overdraft. — A check or draft paid by a bank when there are not sufficient funds of the drawer on deposit to meet the same; to overdraw.

Panic. — A business scare, financial crisis, supposed to be generally without cause.

Permit. — The assent of custom-house officials to the removal of goods.

Protest. — An official declaration by a notary public that a note was not paid when due, or that a bill was not accepted when presented, or paid at maturity; a master of a vessel's statement concerning loss or damage to cargo or vessel.

Puts. — The right to sell a certain stock to a particular party at a fixed time.

Quotations. — Current prices.

Respondentia. — A loan on goods laden on a ship.

Shipped. — Sent, forwarded.

Sight. — The day to present a draft for payment.

Stockholder. – A person who owns one or more shares in a stock company or corporation.

Stocks. — All kinds of securities offered to the public for sale; public funds or securities.

Suspend. — To fail, to cease paying.

Suspense Account. — An account of doubtful debts.

Tare. — An allowance for weight of packing cases, cars, etc., in which goods are shipped.

Teller, or Counter. — A person employed in a bank to receive and disburse money.

Terms. — Conditions or agreements.

Trade-Mark. — A copyrighted mark or brand, the exclusive property of the owner of the copyright.

Value Received. — A phrase used on notes to signify that consideration has been received for the same.

Way-Bill. — A memorandum of goods shipped by common carrier.

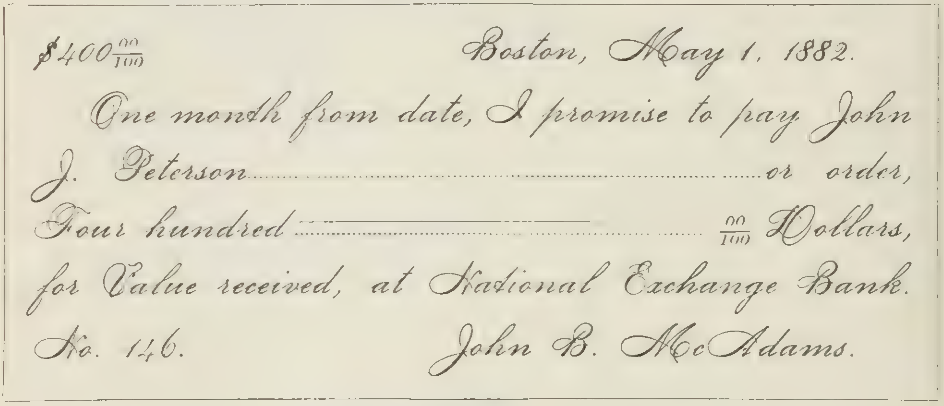
Wire Answer. — Answer by telegraph.

FORMS OF BUSINESS PAPER.

In introducing the following forms for use in business, we have to mention particularly that they are not at all arbitrary; on the contrary, many equally good varieties of the same form will be found. We have only endeavored to present guides or models, which may be altered or modified to suit the circumstances of particular cases, or as the law may vary in different States. (See Legal Department.) In all blank spaces not written in, a line should be drawn, so as to leave no room for interpolations.

NOTES.

I. INDIVIDUAL NOTE.

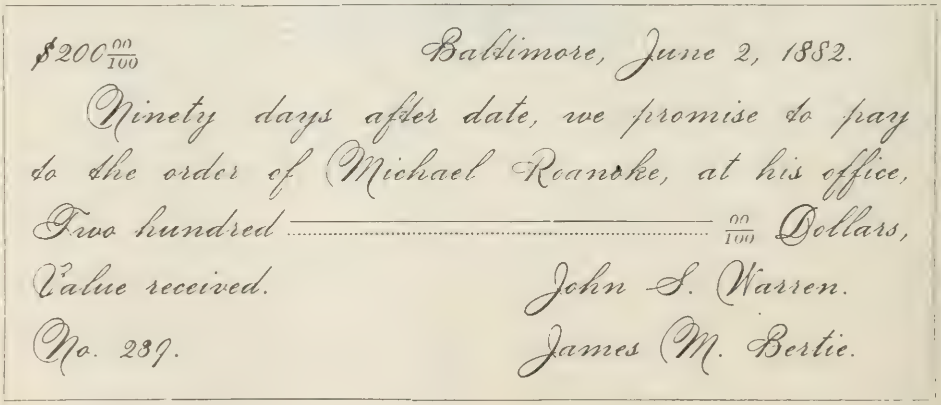


$\$400\frac{00}{100}$ Boston, May 1, 1882.

One month from date, I promise to pay John J. Peterson..or order, Four hundred..$\frac{00}{100}$ Dollars, for Value received, at National Exchange Bank.

No. 146. John B. McAdams.

II. JOINT NOTE.



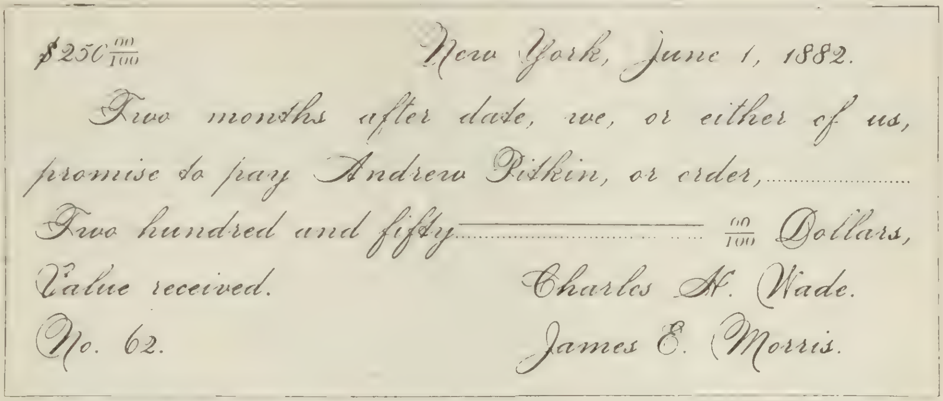
$\$200\frac{00}{100}$ Baltimore, June 2, 1882.

Ninety days after date, we promise to pay to the order of Michael Roanoke, at his office, Two hundred..$\frac{00}{100}$ Dollars, Value received.

John S. Warren.

No. 239. James M. Bertie.

III. JOINT AND SEVERAL NOTE.



$\$250\frac{00}{100}$ New York, June 1, 1882.

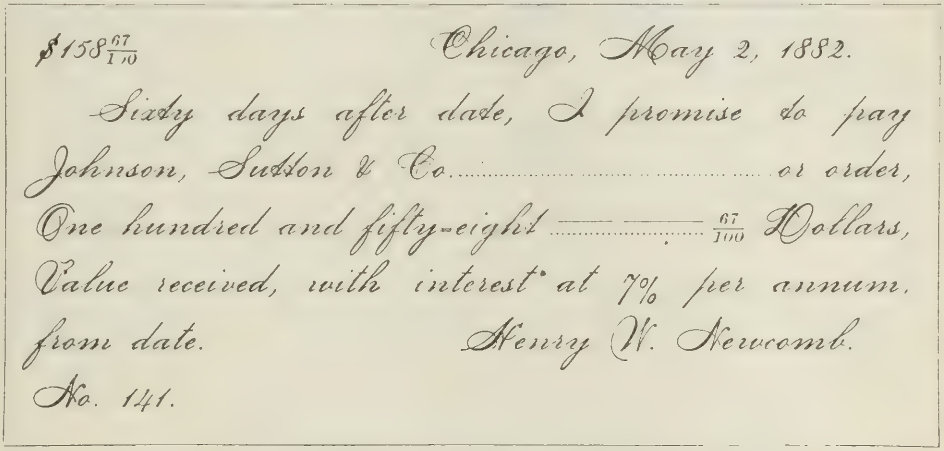
Two months after date, we, or either of us, promise to pay Andrew Pitkin, or order,........................

Two hundred and fifty——————............ $\frac{00}{100}$ Dollars,

Value received. Charles H. Wade.

No. 62. James E. Morris.

IV. NOTE WITH INTEREST.



$\$158\frac{67}{100}$ Chicago, May 2, 1882.

Sixty days after date, I promise to pay Johnson, Sutton & Co.......................................or order,

One hundred and fifty-eight ——————........ $\frac{67}{100}$ Dollars,

Value received, with interest at 7% per annum, from date. Henry W. Newcomb.

No. 141.

V. NON-NEGOTIABLE NOTE.

$\$500\frac{00}{100}$. CINCINNATI, Feb. 19, 1882.

For Value received, we promise to pay to Peter Simonson, on demand, Five hundred $\frac{00}{100}$ Dollars.

No. 686. WILKINS, JONES & CO.

VI. CHATTEL NOTE.

$\$345\frac{00}{100}$. SAN FRANCISCO, July 19, 1882.

Thirty days after date, for Value received, I promise to pay to John G. Allen, or order, Three hundred and forty-five $\frac{00}{100}$ Dollars, in Early Rose Potatoes, at the then market rate, the same to be delivered free of all charge wherever the said Allen stipulates.

GEORGE J. HARRISON.

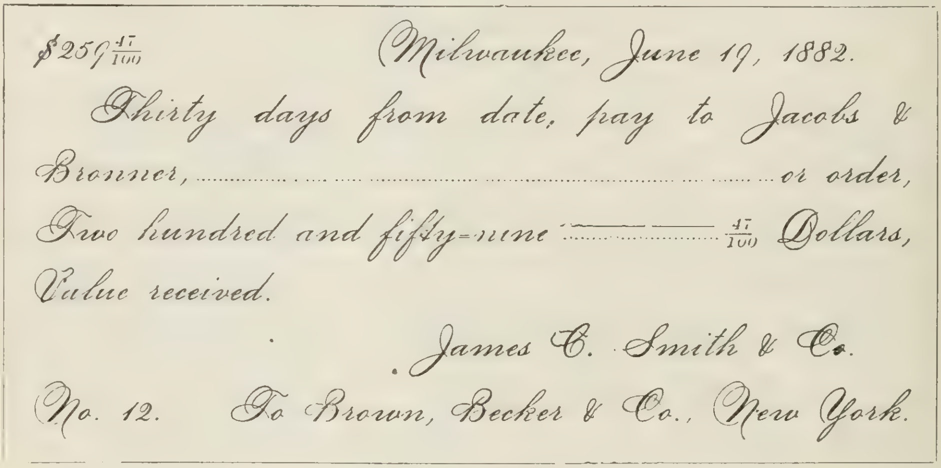
No. 543.

For a variety of reasons, it may be desirable at times to have some guarantee that a given note will be paid when it becomes due. This guarantee is frequently given by a third party, and is then effected by the writing of his name on the back of the note (called indorsing it).

A negotiable note (note drawn to the order of some one) can be transferred to a third party by a similar indorsement. If, however, the drawee (person in whose favor a note is drawn) does not wish to assume the responsibility, he indicates that fact by indorsing "without recourse"; that is, without his guaranteeing the payment of the note. Similarly the note may be transferred to a fourth or fifth party, payment being made to the holder at maturity.

DRAFTS.

I. TIME RECKONED FROM DATE.


$259 47/100 Milwaukee, June 19, 1882.

Thirty days from date, pay to Jacobs & Bronner, ………… or order,

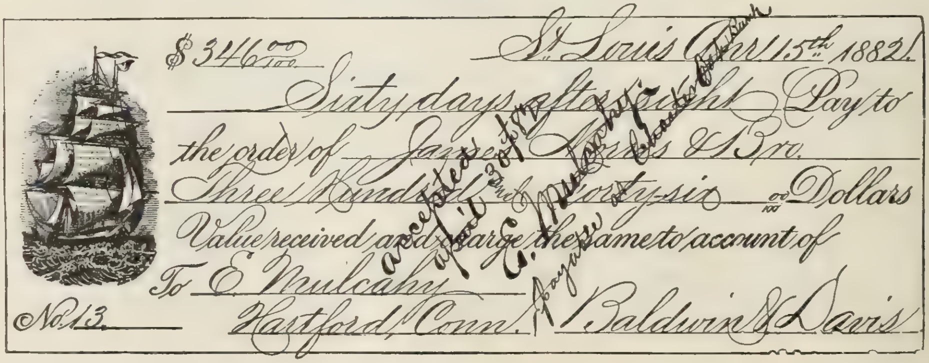
Two hundred and fifty-nine ——— 47/100 Dollars,

Value received.

James C. Smith & Co.

No. 12. To Brown, Becker & Co., New York.

II. TIME RECKONED FROM SIGHT.


$346 00/100 St. Louis Apr 15th 1882.

Sixty days after sight Pay to the order of James Morris & Bro.

Three Hundred and Forty-six 00/100 Dollars

Value received and charge the same to account of

To E. Mulcahy

No. 13. Hartford, Conn. Baldwin & Davis

accepted

April 30th '82

E. Mulcahy

Payable at Charter Oak Bank

SET OF BILLS OF EXCHANGE.

FIFTH NATIONAL BANK,

Exchange for £1,700: 5. 6. New York, June 24, 1882.

1 Thirty days after sight of this **FIRST** of Exchange (Second and Third unpaid), pay to the order of William H Perrin & Co .... One Thousand Seven Hundred Pounds $^{5}/_{6}$ Sterling, and charge same to our account.

To Brown, Shipley & Co., Geo. J Amend,
No. 158. Liverpool, Eng. Cashier.

FIFTH NATIONAL BANK,

Exchange for £1,700: 5. 6. New York, June 24, 1882.

2 Thirty days after sight of this **SECOND** of Exchange (First and Third unpaid), pay to the order of William H. Perrin & Co. .... One Thousand Seven Hundred Pounds $^{5}/_{6}$ Sterling, and charge same to our account.

To Brown, Shipley & Co., Geo. J. Amend,
No. 158. Liverpool, Eng. Cashier.

FIFTH NATIONAL BANK,

Exchange for £1,700: 5. 6. New York, June 24, 1882.

3 Thirty days after sight of this **THIRD** of Exchange (First and Second unpaid), pay to the order of William H. Perrin & Co. .... One Thousand Seven Hundred Pounds $^{5}/_{6}$ Sterling, and charge same to our account.

To Brown, Shipley & Co., Geo. J. Amend,
No. 158. Liverpool, Eng. Cashier.

III. BANK DRAFT.

No. 45. Traders' National Bank, of N. Y.

\$392$\frac{67}{100}$ New York, March 15, 1882.

At sight, pay to the order of James W. Hunt, Three hundred and ninety-two —— $\frac{67}{100}$ Dollars, and charge same to our account.

James D. Sinclair, Cashier.

To Fourth National Bank, Chicago.

RECEIPTS.

I. ON ACCOUNT.

\$250$\frac{00}{100}$ New York, Aug. 15, 1882.

Received from Geo. W. Hunken & Co., Two hundred and fifty —— $\frac{00}{100}$ Dollars, on account.

John B. Carpenter.

II. IN FULL OF ALL DEMANDS.

\$315$\frac{12}{100}$ Chicago, July 10, 1882.

Received from Johnson & Sanders, Three hundred and fifteen —— $\frac{12}{100}$ Dollars, in full of all demands against them.

George C. Peck & Co.

III. FOR PROPERTY.

St. Louis, April 19, 1882.

Received from William H. Williams, to be stored for him as per contract, one hundred cases Shoes, marked and numbered 1 to 100. MICHAEL DRURY & SON.

DUE BILLS.

I. FOR GOODS.

$\$75\frac{00}{100}$ New York, April 22, 1882.

Due Maurice Worms,……………………or order,

Seventy-five……………………$\frac{00}{100}$ Dollars,

payable in Furniture from our store.

Mandel & Norris

II. FOR CASH.

$\$60\frac{00}{100}$ New York, June 15, 1882.

Due George M. Dover,……………………or order,

Sixty……………………$\frac{00}{100}$ Dollars,

with interest from date at 6%.

J. O. Wiley & Co.

ORDERS.

I. AMOUNT STIPULATED.

$\$30\frac{00}{100}$ Brooklyn, May 20, 1882.

Please deliver to Bearer, Thirty $\frac{00}{100}$ Dollars' worth of Stationery, and charge the same to my account.

James O. Hooker.

To G. H. Hunt, N. Y.

II. GOODS STIPULATED.

Boston, May 14, 1882.

Please deliver to Bearer, one case Red Paper Cambrics, and charge the same to our account.

Slade & Dunning.

To P. B. Wyckoff & Son, Boston.

CERTIFICATE OF DEPOSIT.

First National Bank,

500\frac{00}{100}$ Providence, R. I., April 5, 1882.

James G. Brothers has deposited in this Bank
Five hundred .... $\frac{00}{100}$ Dollars,
payable to William H. Underwood, ...
on return of this certificate.

No. 6950. John Smith, Jr., Cashier.

For different forms of checks, deposit slips, etc., see "Banks and Banking."

BILL.

New York, May 15, 1882.

Mr. Wm. N. Thompson,

Bought of CALHOUN, DENNING & CO.,
WHOLESALE BOOT AND SHOE DEALERS,

TERMS CASH. 148 West 4th Street, New York.

	15	*Pairs Ladies' Morocco Gaiters,* @	$2 50	$37	05		
	12	" *Misses' Pebble Goat,* @	2 00	24	00	$61	50
		Rec'd pay't, *Calhoun, Denning & Co.,* *Per J. Erlandsen.*					

INVOICE.

Invoice of one Bale Woollens, shipped per STAR UNION LINE, and consigned to JAS. C. PECK, CHICAGO, to be sold on our a/c and risk, as per agreement.

3	*Pcs. Brown Broadcloth,* 150 *yds.,* @	$2	50	$375	00		
6	" *Black Diagonal,* 240 " "	2	00	480	00		
3	" *Blue Flannel,* 135 " "	1	50	202	50		
						$1,057	50
	Charges.						
	Cartage to Depot,			$0	50		
	Freight prepaid, 300 *lbs.,* @ $1.00 *per* 100,			3	00	3	50
						$1,061	00

E. & O. E. *Thomas Marshall & Co.,*

New York, June 21, 1882. *Per T. J. Caldwell.*

ACCOUNT SALES.

Account Sales of one Bale of Woollens sold on a/c and risk of THOMAS MARSHALL & CO., PHILADELPHIA, as per agreement.

June	26	*For Cash,* 3 *pcs. Blk. Diagonal,* 120 *yds.,*	$2	50	$300	00		
"	27	*Jordan & Marvin,* 3 *pcs. Brown Cloth,* 150 *yds.,*	3	00	450	00		
"	29	*Jordan & Marvin,* 3 *pcs. Blue Flannel,* 135 *yds.,*	2	00	270	00		
"	30	*For Cash,* 3 *pcs. Blk. Diagonal,* 120 *yds.,*	2	50	300	00		
							$1,320	00
		Charges.						
June	26	*Cartage from Depot,*			$0	50		
"	30	" *in delivering,*			2	00		
"	"	*Packing Expenses, Marking, etc.,*			1	00		
"	"	*Advertising,*			1	50		
"	"	*My Commission,* @ 10%,			132	00	137	00
		Net Proceeds as per Draft herewith,					$1,183	00

E. & O. E. *James C. Peck,*

Chicago, July 1, 1882. *Per O. D.*

STATEMENT OF ACCOUNT.

STATEMENT.

New York, March 31, 1882.

Mr. Geo. W. Norton,

To JAS. SMITH & CO., Dr.

TERMS, Cash 10 Days.

March	1	*To Mdse.,*	$500	00
"	5	" "	250	00
"	12	" *Cartage, etc.,*	2	50
			$752	50
		Cr.		
March	15	*By Cash,*	$500	00

In strict justice, whenever a debt is paid after maturity, interest for the overrun time should be added in the payment; but in business circles it is quite customary to waive interest claims on overdue accounts. (It will be borne in mind that generally when goods are bought on account, it is stipulated that they are to be paid for at a certain agreed time; for instance, thirty days after date of bill.) Where, however, this is not done, an equitable adjustment is effected by the preparation of an account current, which is nothing but a statement, as here shown, with an accurate ascertainment of the exact date when the balance of the account is due, which date is found by taking into consideration all the accumulated interest on both sides of the account, as per methods explained in "Arithmetic."

MUSIC.

LUCRETIUS says: —

> ". . . . . The birds instructed man,
> And taught him songs, before his art began ;
> And while soft gales blew o'er the plains,
> And shook the reeds, they taught the swains,
> And thus the pipe was framed and tuneful reed."

IT seems always to have been natural to man to express emotion, like the birds, in music; but the music of the ancients and its notation were much different from that in present use, and much more incomplete.

The Egyptians were the earliest to devote themselves to music, and the Jews obtained their ideas from them. The Egyptians had various kinds of harps, lyres, guitars, pipes, and trumpets, but all of the simplest construction. Among the Greeks, music referred more especially to the melodious interpretation of poetry, which was often improvised.

Greek tragedies and comedies were probably chanted. The choruses were accompanied by flutes, and solos sometimes by the lyre. The scale among the Greeks consisted of five tetrachords, each containing four consecutive sounds, based, not on the octave and its repetition, but on a fourth and its repetition. In modern notation, the ancient Greek scale would be, — B, C, D, E; E, F, G, A; A, B♭, C, D, etc. This was called the diatonic genus. They had a chromatic genus, thus: B, C, D♯, E; E, F, G♯, A, etc.; and an enharmonic genus, the tetrachords consisting of two quarter-tones (which cannot be expressed in modern music), and a major third.

The Romans obtained their ideas of music chiefly from the Greeks, and in the early Christian church the music was chiefly Greek or Hebrew. In the fourth century, St. Ambrose arranged a chant founded upon four of the Greek modes, called the Ambrosian chant.

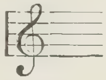
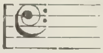
About 600, Gregory the Great enlarged and improved the chant by the addition of four other modes; and it is the same as that now used, and known as the Gregorian chant.

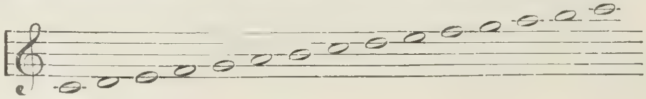
The invention of the organ did much toward improving the music of the church. The first organ on record was presented to King Pepin by the Byzantine emperor Constantine about 700; and many were in use in the tenth century, but of very rude construction.

Guido of Arezzo, in the tenth century, made many improvements in music; and, in the eleventh century, Magister Franco introduced a system of time. From the eleventh to the fifteenth, but little is known. By the seventeenth century, the present scale, called the diatonic, had become developed, although even now the scales in use in China, India, Scotland, and Ireland differ slightly.

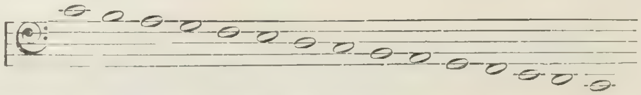
The diatonic scale consists of a succession of notes at intervals of whole tones, except between the third and fourth, and seventh and eighth, from the key-note, where the interval is a half-tone. Upon the piano and organ, a certain scale, called C natural, is arranged with white keys, the intervals being whole tones, except between the third and fourth, and seventh and eighth from C, where the interval is a half-tone.

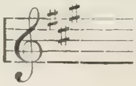
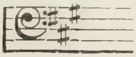
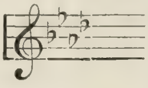
The eighth, called the octave, is likewise C; and the notes of each succeeding octave are named as follows: C, D, E, F, G, A, B, C. An interval of half a tone is called a semitone, and a succession of semitones forms what is called a chromatic scale. To produce the semitones upon the key-board, black keys are introduced between the first and second, second and third, fourth and fifth, fifth and sixth, sixth and seventh; and, as between the third and fourth and seventh and eighth there is only a semitone, no black key is possible in those places. The half-tone next above any note is called the sharp (♯); and the half-tone next below, the flat (♭) of that note.

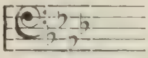
The natural scale just described is called major. Of those called minor there are several, but the one generally used has a flat (minor) third, — that is, making the semitone between the second and third, instead of third and fourth; and a flat sixth, making a semitone between the fifth and sixth, a tone and a half between the sixth and seventh, and a semitone between the seventh and eighth. Any major scale may be started from any note taken as the key, or foundation note, if the intervals be maintained as above described for the scale of C, — that is, all whole tones, except between the third and fourth, and seventh and eighth, where must be semitones. If a scale be started from G, by playing G, A, B, C, D, E, we find the intervals correct; but a semitone between E and F, and a whole tone between the seventh and eighth, F and G. Therefore we sharp F, which makes it right. G is the key of one sharp. The key of two sharps will be found a fifth above G, which is D; three sharps, a fifth above D, which is A; and so on to seven sharps. If we begin the scale on F, we find it necessary to flat B to make it right. The fourth below F requires two flats; the fourth below that, three flats; and so on to seven flats. In musical notation, the air is written upon a series of five parallel lines, marked by a signature at the beginning, called treble clef, thus,  The lower part, called the bass, is written upon a similar series with a mark called the bass clef,  The five lines and their spaces are called a staff. In the treble cleff, the middle C of a key-board is written upon a little line below the staff, called a leger line; and the natural scale beginning with middle C is written upon successive lines and spaces, thus,—



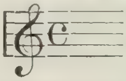
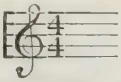
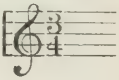
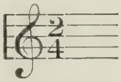
From middle C down through the bass clef, thus, —



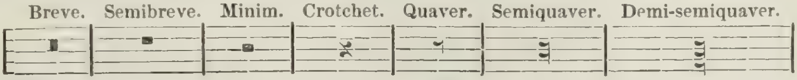
The above scales together comprise four octaves, which can be extended in opposite directions. When the treble and bass are played together, the two staffs are connected by a brace. The key is indicated by what is called the signature at the beginning, which designates the number of sharps or flats required The sign ♯ or ♭ is placed upon the space or line whereon the note to be sharped or flatted comes. Thus, for three sharps, F, C, G are sharped,   for four flats, B, E, A, D are flatted, 

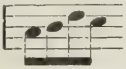
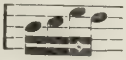
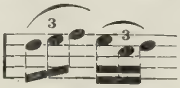
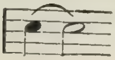
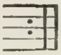
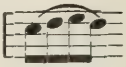
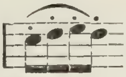
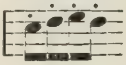
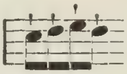
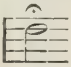
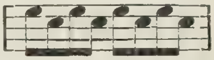
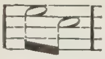
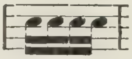
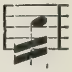
 A sharp or flat introduced into a piece which does not appear in the signature is prefixed to the note and called an accidental, and is changed back by a sign (♮) called a natural. A double sharp occurring as an accidental is indicated thus, ×; a double flat, thus, 𝄫, which makes a difference of a whole tone instead of a semitone. The principal minor scale requires an accidental. The signature is the same in the minor as the major, but the relative minor will begin a minor third below the corresponding major scale of the same signature.

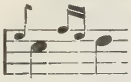
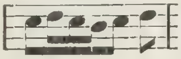
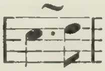
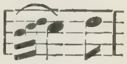
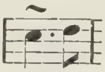
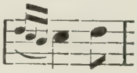
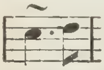
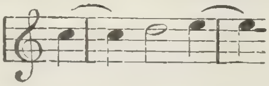
RHYTHM.—The duration of notes is indicated by their form. The longest, called the breve, is written thus, (𝅜); the semibreve or whole note, thus, (𝅝); the minim or half-note, thus, (𝅗𝅥); the crotchet or quarter-note, thus, (♩); the quaver or eighth-note, thus, (♪); the semiquaver or sixteenth-note, thus, (𝅘𝅥𝅯); the demisemiquaver or thirty-second note, thus, (𝅘𝅥𝅰) It takes two minims, four crotchets, eight quavers, sixteen semiquavers, and thirty-two demisemiquavers to make a semibreve or whole note.

The staff is divided into spaces which must contain notes, the sum of whose values must always equal the number indicated in the signature. What is called common time (march time) is indicated thus,  or  that is, four quarter-notes in a measure. The denominator indicates the value of the notes; the numerator, the number of notes taken; $\frac{3}{4}$ time (waltz time) is expressed thus,  polka time, thus,  other kinds, thus, $\frac{3}{8}$ $\frac{6}{8}$ $\frac{12}{8}$ etc.

When silence is required, it is indicated by a mark called a rest, which takes its name and value from the note for which it stands, thus:—



A note or rest is lengthened one half by placing a dot after it, thus, ♩· 𝅗𝅥·; three fourths by two dots, thus, ♪·· ♩··. Several quavers are united where they occur in succession, thus, ; semiquavers, thus,  Notes are written sometimes in triplets, the accent coming on the first, and the three are played in the time of two. They are written thus, ; that is, enclosed by a curve and 3 under it. When the same note is repeated, and the notes tied by a curve, they are played as one, thus,  Two dots before a double bar signify that the previous part is to be repeated,  Notes are to be played smoothly when slurred, thus,  more distinct when written thus,  ; very distinct when marked thus,  and must be struck sharply (called staccato) when marked thus,  A note to be held longer than the time indicates is marked by a curve and dot called a hold,  Any part marked *8va.* over the notes is to be played an octave higher as far as the mark extends; but, if the mark is written below the bass, it signifies an octave lower. A measure may be abbreviated by indicating the time by the head of the note and the kind of notes to be played, by a bar or bars at the end of the stem. The passage  may be written thus,  ; the passage  may be written thus, 

Grace notes are little notes placed before a note as embellishments, as, for example,  A turn  is indicated thus,  An inverted turn played  may be expressed thus,  ; a partial turn  thus,  the difference being in the position of the mark ~. When a sound begins on an unaccented part of a measure, and is continued by a tie upon the accented part of the next, it is termed syncopation,  A gradual increase of sound is indicated by a crescendo, <; a decrease by a diminuendo, >. A swell is indicated thus, < >; a sudden burst of sound thus, >; a pressure tone (sudden swell), <>; piano (soft), *p.*; pianissimo (very soft), *pp.*; mezzoforte (medium loud), *mf.*; forte (loud), *f.*; fortissimo (very loud), *ff.* Ped. stands for the loud pedal, which is terminated by this sign, ✻.

Harmony — also called thorough-bass, from the old method of indicating the intervals of chords by figures instead of notes — consists in the agreeable combination of notes; although a disagreeable combination, called *discord*, is sometimes used before an agreeable one, called a *concord*, to render it more effective or forcible.

The most agreeable combination by itself is composed of the key-note, its third and fifth. The key-note is called a tonic. Taking C as a tonic, the chord would be C, E, G; and this chord, if any, must finish every piece, the lowest note in the bass being the key-note. The intervals of a second, third, fourth, fifth, sixth, seventh, etc., are reckoned up from the key-note.

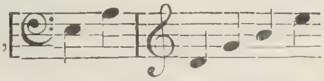
The first, third, and fifth, founded on the key-note, is called the tonic triad (common chord). Triads may be founded upon any note in the scale, but will not always have the same intervals. A tonic triad has a major third (consisting of two whole tones), but a triad founded upon the second of a scale will have a minor third (a tone and a half). A triad having a perfect fifth is called major or minor, according to its third. A triad founded on the third is minor; on the fourth, major; on the fifth, major; on the sixth, minor; and on the seventh, imperfect, having a minor third and flat fifth. If to the triad founded on the dominant (fifth) its seventh be added, we have a chord called the dominant seventh, which resolves (flows) into the tonic triad. If to the tonic the fourth and sixth be added, we have another chord, called the chord of the fourth and sixth.

A most useful chord for modulating through different keys is the "diminished seventh." It consists of an imperfect triad with a flat seventh added, or of any four notes separated by equal intervals of a tone and a half, that is,—a succession of minor thirds. All these chords may have as many positions as they have different notes, as any note may become the root (lower note). Close and dispersed harmony are what the terms "close" and "dispersed" signify. Broken chords are those whose notes are played in succession. Arpeggios are a succession of broken chords.

Classical music is that which conforms in all particulars to the laws which have been found to produce the best possible effects. Some of the principal composers for piano and organ are Bach, Handel, Haydn, Glück, Beethoven, Mozart, Schubert, Mendelsshon, Schuman, Chopin, and Wagner; the last having founded a new school of composition, in which emotion is made subordinate to the intellect. Organ music is usually written especially for that instrument, as the sounds can be sustained; and the principal form of composition is the fugue, in which the idea is caught up by the bass and treble alternately, like a dialogue. The principal form of composition for the piano-forte is the sonata, which consists of four or more movements, as andante, allegretto, adagio, scherzo, and allegro or presto. The concerto is a more brilliant form of the sonata, adapted to the concert-room, usually played with an orchestral accompaniment.

Other forms, as the nocturne, capriccio, etc., take their names from the idea expressed. Mazurka and Polonaise are forms of Polish dances.

The organ and all stringed instruments admit of several parts being played at once. The harp differs from the piano in that the strings are snapped by the fingers, instead of struck by hammers, and is tuned like the piano.

The guitar has six strings, tuned in fourths, thus,  The divisions for semitones are made by pressing the strings with the fingers of the left hand against a series of bars called frets. The strings are snapped with the right hand. The violin has four strings, and is tuned in fifths, beginning with G below the staff; the viola, in fifths, beginning with the octave below middle C; the violoncello, in fifths, beginning two octaves below middle C; the double bass, beginning on the second E below the bass staff, in fourths, E, A, D, G. Brass instruments have their natural scale, usually in two or three flats, B♭ or E♭. An E♭ will play in C, as it were, when the piano plays in three flats; and, if the piano play in two flats, an E♭, to be in the same key, must play in one sharp to cancel one of its flats. There are four sizes of clarinets, tuned respectively in A, B♭, C, and E♭. The A is the lowest, A below middle C. Flutes are usually in D, though sometimes in F. The oboe is in C, and fingered like the flute, the sound being produced by a small double reed. The cabinet organ is made with reeds of brass, which can be tuned by slightly filing, which at the end of the tongue sharpens the note, but at the base flattens it. A mere touch is required to alter the smallest reeds. To tell when the note is too flat, press down the octave slightly, and the beats in the sound, if increased, indicate that the note is too sharp: but, if the beats are lessened, the note is too flat. The piano is tuned by a hammer with a socket in it to fit the pegs on which the strings are wound. Ordinary pianos have two strings and grand pianos three strings to a note, tuned in unison, except in the lower one, or two octaves, which have but one string to a note. Upon the piano (as also the organ) it is found that, if the notes are tuned in perfect fifths, the octaves will be out: it is therefore necessary to tune the fifths slightly flat, which makes the octaves perfect.

To lay a scale, begin by tuning the fifth above the note you start on, tuning the fifth very slightly flat; then tune the octave of that fifth perfect; then from that octave tune another fifth slightly imperfect and its octave perfect; and so on until the different notes of the scale in the middle of the instrument are perfect, then tune the balance by octaves.

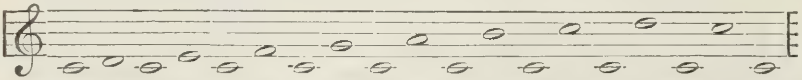
When you have two strings to a note, tune one first by putting a wedge against the other; and when the first string is right, tune the second string in unison.

VOCAL MUSIC.

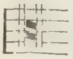
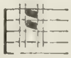
The larynx, the instrument of the voice, requires much care in its development, as it is easily changed for the better or worse. It should never be strained by singing too loud or too long at a time.

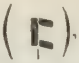
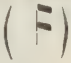
One should practise with an instrument that is in tune, taking care not to sing too sharp or too flat. Unless one has naturally an excellent ear, it is necessary, in order to sing in tune, to sing with an instrument or with correct singers. Always, before commencing to sing, take three or four full, deep breaths, throwing the shoulders back with the body erect, to expand the lungs. By doing this, it will be found easier to sing, and it strengthens the chest.

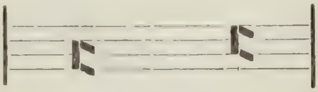
Begin on any low note, and sound the syllable *la*, not *law*, but give it the sound of "a" in "art," which will serve to open the throat. Have your lungs full to begin. Sound the note gently, then swell to as great power as you can and preserve a musical tone, taking great care not to sharp; then diminish the tone gradually to a whisper, taking great care not to flat. Practise each note of the scale in the same way. Then begin the scale a note higher, and so on until it reaches as high as you can produce a musical tone. Also begin a note lower each time until you can go no further. Strike every note squarely, repeating it until you feel sure where it is. Practise the following intervals in all the keys, striking each note squarely and repeating each interval until you feel sure of the note: —



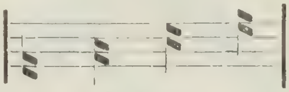
If you prefer, you can use, instead of *la* the syllables Do, Re, Mi, Fa, Sol, La, Si, Do, which came into use accidentally, being the initials of certain words in a Latin hymn which came upon successive notes of the scale; Do, being originally Ut, and Si was added afterwards. Practise sliding from one note to the next, especially in the chromatic scale, which will give facility, in intervals of a semitone. The exercises of any instruction-book for piano or a solo instrument can be used to advantage with the voice. The soprano and contralto are written in the treble clef, which is called the G clef. In solos or four-part music, the tenor is usually in the treble clef. In old music a clef called the C clef is used: and for the alto is written

; for the tenor,  The bass is in the bass clef, which is called the F clef.

Besides the above system of notation, another is extant, called the plain chant notation, and used in the service of the Catholic Church. Four lines with three spaces constitute the staff. For this system two clefs are used, the *Fa* clef (), which is the lower of the two, and is placed on either the third or fourth lines, and the *Do* clef (), which can be placed on any of the four lines, according to the requirements of the hymn.

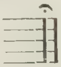


Fa Clef.



Do Clef.

Fa, the fourth degree of the scale, will come on either the second or third lines. *Do*, the first degree of the scale, is sung on any of the four lines.

Accellerando, — to be accelerated.
Adagio, — a very slow movement.
Ad Libitum, — at discretion.
Affetuoso, — affectionately.
Agitato — agitated.
Allegretto, — lively.
Allegro, — more rapid than allegretto.
Al Segno, or :S:, signifies return to similar mark and play to Fine or 
Andante, — slow and gentle.
Andantino, — a little slower than andante.
Animato, — animated.
Assai, — very.
A Tempo, — in regular time.
Barcarolle, – Venetian boat-song.
Ben Marcato, — well marked.
Brillante, — brilliantly.
Cadenza, — a fanciful embellishment.
Cantabile, — in singing style.
Con Brio, — with spirit.
Con Fuoco, — with fire.
Con Dolcezza, — with sweetness.
Con Dolore, — mornfully.
Con Gravita, — with gravity.
Con Grazia, — with grace.
Don Gusto — with taste.
Con Moto, — agitated.
Con Sordini, — with mutes.
Da Capo, or D. C., — from beginning.
Dolce, — soft, sweetly.
Dolcemente, — gracefully.
Doloroso, — pathetically.
Eleganza, — with elegance.
Espressivo, or Con Espressione, — with expression.
Forzando, or Forz, or fz, — with strong emphasis.
Furioso, — furiously.
Giusto, — in exact time.
Grandioso, — in grand style.
Gravemente, — gravely.
Grave, — the slowest movement.
Impetuoso, — impetuously.
Innocente, — artless.
Interlude, — an intermediate strain.
Larghetto, — slow and measured.
Largo, — very slow and solemn.
Legato, — smoothly.
Legatissimo, — very smooth and connected.
Leggiero, — with lightness.
Leggierissimo, — very lightly.
Lentando, — increasing slowness.
Lento, — slowly.
Loco, — as written.
Maestoso, — majestic.
M. D., Main Droite, – right hand.
M. G., Main Gauche, — left hand.
Mezzo, — medium.
Moderato, — moderately.
Molto, — much.
Morendo, — dying away.
Obligato, — a necessary part.
Ossia, — or else.
Piu, — more; *Pius*, — more.
Poco, — a little.
Portamento, — gliding.
Presto, — quick.
Prestissimo, — very quick.
Quasi, — like.
Rallentando, — diminish in speed.
Riuforzando (*rf*), — with emphasis.
Scherzando, Scherzoso, — playful.
Semplice, — simply.
Sempre, — always.
Senza, — without.
Serioso, — seriously.
Sforzato, or Sforzando (*sf*), – emphatic
Sostenuto, — sustained.
Staccato, — detached, short.
Subito, — suddenly
Tacet, — silent.
Tanto, — much; *Non Tanto*, — not too much.
Tempo Rubato, — slackened time.
Tranquillo, — tranquilly.
Tutta Forza, — loud as possible.
Tutti, — all.
Una Corda, — one string, soft pedal.
Velocissimo, — with great velocity.
Vivace, — lively, vivacious.
Vivacissimo, — very lively.
Vivo, — lively.
Volante, — light and rapid.

INTRODUCTIONS.

BEFORE introducing people to each other, be sure that the introduction will be mutually agreeable. It is to be remembered that an introduction is regarded as a social indorsement of the person introduced, and hence, under certain circumstances, it would be wrong to introduce to our friends casual acquaintances of whom we know little or nothing, and who may afterwards prove anything but desirable persons to know. Whenever practicable, this point should be settled by previously ascertaining if an introduction would be agreeable; but when for any cause such inquiries cannot be made, a thorough acquaintance with both parties will warrant the introducer to decide as to the proper action.

As a general rule, a man should be as careful about the character of the person he introduces to his friends as he is in relation to the stability of him whose notes he would indorse. Especially is this true where a gentleman is to be introduced to a lady; in such a case her permission should be previously obtained. It is the part of the host and hostess, at a private party or ball, to introduce their guests, though this duty is often delegated to a near friend, who is acquainted with a majority of the company.

The French, and to some extent the English, dispense with introductions at a private party or ball, where the fact that the persons present have been invited is regarded as a sufficient guaranty of their respectability, and a sufficient warrant for self-introduction.

Forms of Introduction. — The proper mode of introduction is to present the inferior to the superior, the younger to the elder, the gentleman to the lady. Thus, in introducing a gentleman to a lady, make a slight inclination of the head and a gesture with the right hand indicating the parties named, and say, "Miss Adams, permit me to introduce my friend Mr. Sabine"; "Capt. Haskell, allow me to present Mr. Barnes." When a gentleman is introduced to a lady, both bow slightly, and the gentleman opens conversation; and in general it is the place of the one who is introduced to make the first remark, which he may do by saying, "It gives me great pleasure to form your acquaintance," or words to that effect. It is advisable to repeat the names of the parties introduced at the close of the introduction, so that they may better understand each other's names. Care should be taken to speak each name clearly. In case a person does not hear distinctly he may say at once without diffidence, "I beg your pardon, I did not catch the name," when it should be repeated.

Where a number of persons are to be presented to a single individual, mention the party's name first, and then call the others in succession, each bowing slightly as their name is pronounced; or if too large an assembly, or not easily done, a general announcement is sufficient. It is customary and courteous, when introducing a person from a distance, to mention the place from which he comes, as: "Mr. Conroy, of Cincinnati," or, "Mr. Williams, who has recently returned from Paris." If he be a clergyman, say, "the Rev. Mr. Clark"; or if a man of celebrity in the world of art or letters, that fact can be mentioned, thus: "Mr. Holland, author of 'Bitter Sweet,' which you so much admire"; or, "Mr. Hardon, the artist, whose pictures we saw at the gallery." By this means a topic for conversation is opened. Although it is not necessary to introduce people who chance to meet at your house during a call: still not to do so would be a mark of ill-breeding; better not have them meet at all, than to meet and not be presented. If there is reason to suppose that such an introduction will not be objectionable to either party, it is preferable to give it.

When you introduce a relative, be careful to give the surname, as this will prevent awkward mistakes; for if a stranger is introduced to "my sister Maud," or "my cousin Mabel," and she be a married lady, her name will probably become known only by chance or by guess. A bow only is required at an introduction. Shaking hands is optional, and rests with the lady, the superior, or elder person, who should make the first advances.

A married woman should extend her hand upon being introduced to a stranger brought to her house by her husband, or an old friend, thereby giving evidence of a cordial welcome.

If, while out for a walk with a companion, you meet and stop to speak with a friend, it is not required that you should present your companion, although it would seem in better taste to do so. However, whether introduced or not, your companion is expected to participate in the parting salutations.

After an introduction, it is the lady's privilege to take the first steps toward a continuance of the acquaintance, and when she bows, the gentleman is bound to return it.

When men meet, a bow, a slight movement of the hand, or a touch of the hat is sufficient; though a gentleman in bowing to a lady should not merely touch his hat, but should lift it from his head. In the country, where the localities are thinly settled, the habit of bowing to every one you meet is an excellent one, evincing as it does kindness of feeling toward all. The "cut direct," if under any circumstances justifiable, can only be so when the individual has been guilty of the most disreputable conduct; and, as before stated, very few instances can arise where it would be proper to dispense with the formal bow of recognition, which of itself encourages no familiarity. If on calling at a house you find present only members of the family with whom you are unacquainted, hasten to introduce yourself at once. Where this is not done much awkwardness may be occasioned.

In Washington official society, the guest attending a Presidential reception is presented by the master of ceremonies. At other times, persons of influence secure private interviews with the President by simply presenting their cards; but others need an introduction by a member of Congress or some person of note.

A great deal of formality is observed in presentations at Court in foreign countries: thus in England, the stranger bearing the credentials of the American ambassador will be introduced: if a lady by a lady, or if a gentleman by a gentleman. At every European capital we have a national representative, called a minister, who will give all necessary instructions to those who desire to be presented at Court, and see that all forms are complied with. Court etiquette requires that the lady and gentleman appear in full dress, which is governed by custom and usage in the various Courts of European countries.

SALUTATIONS.

Each nation has its own peculiar method of salutation. In Africa it is the custom to rub toes. In Lapland your new acquaintance rubs his nose against yours. The Turk folds his arms upon his breast and bends his head very low. The Moors of Morocco have a somewhat startling mode of salutation: they ride at a gallop toward a stranger, as though they would unhorse him, when close at hand they suddenly check their horses and fire a pistol over the person's head. The Egyptian solicitously asks, "How do you perspire?" and allows his hands to fall to his knees. The Chinese bow low and inquire, "Have you eaten?" The Spaniard says, "God be with you, sir," or, "How do you stand?" And the Neapolitan piously ejaculates, "Grow in holiness"; while the German asks, "How goes it with you?" The Frenchman inquires, "How do you carry yourself?"

Foreign nations are much given to embracing; thus the Frenchman kisses his bearded son upon the forehead, and friends throw their arms around each other's necks and hug one another as if lovers.

In America the modes of salutation are the bow, the hand-shake, and the kiss, while the words used are, "How do you do?" "Good morning," "Good evening," "I 'm glad to see you." The last three forms are, perhaps, preferable, as it seems useless to inquire concerning a person's health and then not wait for an answer. The bow, as a certain writer has said, is "a note drawn at sight which you are bound to acknowledge to the full amount." It should be respectful, familiar, or cordial, according to circumstances; the moment the eyes meet you should bow, whether it be on the street or in a room. It is not necessary to bend the body; an inclination of the head is all that is required.

A bow should never be accompanied by a broad smile; yet, says an eminent writer on the subject, "you should never speak to a friend without a smile in your eyes."

As before stated, a gentleman, in bowing to a lady, should raise his hat completely from his head, and should he chance to be smoking, remove the cigar.

It is the lady's place to first recognize her gentleman friends with a graceful inclination, though among intimate acquaintances the salutation is often simultaneous.

The same respectful deference is due from a young woman to an older one than herself that is shown by a gentleman to a lady. This is also true of the respect manifested by a young to an elderly man.

A man should return a bow made him upon the street, even if the one making it is not recognized. He may be a forgotten acquaintance, or, if a mistake has been made, there will be less embarrassment if the bow is returned.

A gentleman when walking with a lady should raise his hat to those who recognize her, even though he be unacquainted with them; by this means he shows respect for them out of respect for his friend. On a promenade or public drive, a bow is all that courtesy demands from an acquaintance; but if you meet again, and it be a friend, it is better to smile or make some pleasant remark. Among friends, the most cordial and genuine expression of good-will is the shaking of the hand.

Some European nations give the left hand for this purpose, as being nearest the heart; but we should always give the right, unless from circumstances it be impossible or inconvenient; hence, when a gentleman enters a room, he should carry (if at all) his hat, gloves, etc., in the left hand, thus leaving the right free to salute friends.

Should, however, two gentlemen be presented to another, he may extend both hands to receive theirs, but it is still better taste to present the right hand to each, one after the other.

A man has no right to take a lady's hand unless offered, but he should instantly extend his should she make an advance.

In a ball-room, where the introduction is for the purpose of dancing, and not friendship, as a rule the introduction should be followed only by a bow. There are, however, exceptions to this. Strict etiquette requires the removal of the glove when about to shake hands; but this is not necessary if it would cause inconvenience or an awkward pause. In such a case, simply say, "Excuse my glove," or use some similar expression.

The kiss of respect upon the hand, though retained in England among some courtly gentlemen of the old school, is nearly obsolete in this country, but is a pleasing and graceful custom. The kiss of relationship upon the cheek or forehead, especially from children to parents, is perfectly proper, though seemingly regarded with growing disfavor. There can scarcely be a more pleasing sight than a young man kissing his aged mother, or a young lady her father at parting, or after an absence. There seems to be a custom which gives at least a kind of sanction to women kissing each other in public. Still there may appear a certain touch of vulgarity about it which might cause a lady of really delicate perceptions to avoid it.

Visiting Cards.

To a certain class, the visiting card is but a trifling and insignificant bit of paper, to be thrown aside as soon as read, but to the disciple of social law it conveys a subtle and unmistakable meaning. Its texture, style of engraving, and even the hour of leaving it combine to place the stranger whose name it bears in a pleasant or a disagreeable attitude, before his manners, conversation, and face have been able to explain his social position.

The texture of cards should be fine, the engraving a plain script; the size should be neither so small as to create an impression in the mind of the recipient that you are eccentric, nor so large as to suggest ostentation.

A card used in calling should have nothing upon it but the name of the caller. There should be no ornamentation, device, or flourish of any kind. It should be white, and for matter, the name in the centre is all that is needed.

The street and number always appear better on the card of the husband than upon that of the wife. A lady's card should not bear her place of residence; when necessary, it may be added upon the card in pencil.

There should be no special parade of titles. To use the prefix Prof., Hon., or Judge is not good taste, though M. D. may follow a physician's name, and an army or naval officer can use his title if he chooses, though it is better to use the letters representing the branch of service he is in, as U. S. A., or U. S. N. Business cards should not be used for a friendly call.

The signification of turning down the corners of cards are:—

Visitor. — The right-hand upper corner.
Felicitation. — The left-hand upper corner.
Condolence. — The left-hand lower corner.
P. P. C. — Right-hand lower corner.
Delivered in Person. — Right-hand end turned down.

The card of a married lady usually gives her husband's name, with the prefix "Mrs." attached, as, "Mrs. Jones Harwood," instead of "Mrs. Nellie M. Harwood." Where the wife has sufficient personal importance to be known separate from her husband, custom is beginning to sanction the latter method. A wife in that case generally gives her maiden name in full, as "Mrs. Nellie Munroe Harwood."

A wife in taking her husband's name does not take his title. The wife of Dr. John Brown is not Mrs. Dr. John Brown, or even Mrs. John Brown, M. D , but plain Mrs. John Brown. The wife of a congressman is not a "Mrs. Hon.," or an "Hon. Mrs.," nor is the wife of a clergyman a "Mrs. Rev."

Unmarried ladies, as a rule, should not prefix "Miss" to their names, as it is understood that they are not married when the name alone appears. Married ladies should always prefix "Mrs." to their names.

Wedding cards are sent to relatives and those whom the newly married couple desire to retain among their acquaintances, and to those with whom they have been on intimate terms. When sent, it is the duty of the recipients to call first on the young couple.

When there is no wedding reception, some of the wedding cake is sent with the cards. This is a custom that has grown up of late years, but it is not always observed.

A charming custom that is coming into vogue is the giving or sending of Easter and Christmas cards. They are decorated with elegant designs, and in a variety of colors; some of them are very pretty. Verses of poetry are printed upon them in the most artistic manner appropriate to the season in which they are sent, and which are supposed to convey the good-will of the party sending to the receiver. The borders are sometimes adorned with silk floss fringe, and they are generally kept as souvenirs by those who are fortunate enough to receive them.

A card may be made to serve the purpose of a call, and it may be sent by mail, by a messenger, or left in person. The card for the lady of the house is folded in the middle. If guests are visiting at a house, a card is left for each guest.

If a call made in person be returned by a card in an envelope, it is an intimation that the person sending it desires visiting to cease. An exception to this rule is where they are sent in return to the newly married living in other cities, or in answering wedding cards forwarded when absent from home.

A card left at a farewell visit, before a protracted absence, may have "P. P. C." (*pour prendre congé*, to take leave) written in one corner, though they are seldom used now.

CARDS OF CONGRATULATION may be left in person, or a congratulatory note may be made to serve the purpose of a call. Calls in person are due to the newly married and to the parents who have invited you to the marriage.

Cards should be left in person after an invitation has been sent, whether it was accepted or not.

A MORNING CALL.

When only the relatives and most intimate friends of a bride and bridegroom have been included in the marriage invitations, the bridegroom often sends his bachelor card to those of his friends with whom he desires to remain on visiting terms. A call should then be made upon the bride within two weeks after she becomes mistress of her new home.

Cards of condolence from acquaintances should be left in person, and an inquiry made after the health of the family.

There is a European custom rapidly gaining favor among Americans, of sending to friends and acquaintances cards telling of the death of any member of the family of which they otherwise might remain in ignorance. They are generally formed and worded as follows: —

Miss Alma Robinson.

Born Aug. 1, 1862.

Died at Baltimore, June 1 1882.

Sometimes a verse of poetry is added. The French card is much more elaborate, all the relations unite in the notification, and if deceased be a Catholic, in requesting the receiver's prayers for the deceased.

CALLS.

Calls are generally either of ceremony, congratulation, condolence, or friendship. The latter is usually less formal and may be more protracted than the others.

Among those who desire to be fashionable, calls are termed "morning" or "evening," according to the time at which they are made.

Do not pay a visit or call before noon, unless it is necessary. Nearly every lady is busy in the forenoon attending to her household duties. Most families dine from twelve o'clock till half past one, and are consequently unprepared for the early reception of visitors.

Morning Calls are usually made from one to five o'clock in the afternoon, and should not exceed half an hour in length, while ordinarily from fifteen to twenty minutes is long enough. On making a call, send in your card by whoever answers your summons at the door, if the friends called upon are at home. This method is much better than trusting your name to a servant, by whom it may be forgotten or mispronounced. Should other visitors chance to come in, your call should terminate as soon as possible.

As before stated, it is not positively necessary that visitors at morning calls be introduced to each other; still it is preferable, and in any case, upon taking leave, bow slightly to the strangers.

When a call is to be made, be careful to avoid the lunch or dinner hour of your friends. If the person or persons upon whom you call are not at home, leave your card.

EVENING CALLS.—It is often more convenient, both for the caller and those called upon, that the call take place in the evening. When this is the case it should not be over an hour in duration, never being made later than nine o'clock and not being prolonged after ten. A gentleman receiving a lady meets her at the door, and at the close of her call accompanies her to the steps, and a lady should likewise accompany a lady visitor to the door unless other guests claim her attention.

Calls in the country are less ceremonious than in the city. It is not customary in cities or towns to offer refreshments; but in the country, especially where the caller has come from a distance, it is hospitable to do so.

Should you find the person upon whom you have called dressed to go out, do not prolong your visit.

NEW-YEAR'S CALLS.—On this day, gentlemen renew their acquaintance with ladies and families, some of whom they may not have been able to meet during the whole year.

To add to the pleasures of the day, a number of ladies frequently unite in receiving calls at the residence of one of their number.

Gentlemen call singly, in couples, and even by threes and fours, in carriages or on foot, as they choose. When gentlemen thus go in parties, calls are made upon the lady friends of each, and those who are acquainted introduce the others.

New-Year's calls begin about eleven o'clock in the morning, and continue until about nine in the evening. The length of such calls is usually from ten to twenty minutes, though they may be prolonged by circumstances. Refreshments—such as cold meats, salads, fruits, cakes, sandwiches, and hot tea and coffee—should be offered, though it is not always necessary to accept them. Cards are often used in this class of visits bearing sentiments of friendship, such as "Many happy returns of the day," "Happy New Year," etc., forming to the ladies who receive them pleasant remembrances of the day.

NOT AT HOME.—A caller should take special care to make his visits at an opportune hour, though a lady should endeavor to receive her visitors at any reasonable and proper time they may call; but if she is so employed that this is impossible, the person who answers the bell should be instructed to say that she is "engaged" or "very busy."

Do not, however, allow a caller to send up his card or name, and then return the message "engaged," as it would thus appear as if a personal or special reason caused the refusal to see the visitor. When exceptions are to be made in regard to certain individuals, their names should be mentioned to the servant.

Some ladies by instructing the servants to say they are not at home, when the contrary is the fact, set a bad example to the servants and the children, while if visitors find it out, as they may, it is to them a just cause of offence.

GENERAL RULES IN REGARD TO CALLS.—Do not, while waiting for your hostess, touch, examine, or inspect anything too closely, or open the piano, or walk around the room examining pictures, etc.

Do not, when making calls, allow young children or pets to accompany you, unless you know they will be welcome, as they often prove troublesome. Do not offer to go to the room of an invalid upon whom you have called, but wait for an invitation to do so.

In making an informal call, the hat, gloves, overcoat, and cane should be left in the hallway, if not taken by the servant.

A lady in making a call may bring a stranger with her without previous permission, but a gentleman should not take that liberty. A lady does not usually call upon a gentleman except on business; and it is better even then to be attended.

If not at home when a gentleman calls, a lady should always avail herself of the first opportunity to express her regrets to him for being absent, and he should reciprocate; and never in any case should he treat it as a matter of no consequence.

A hostess should pay equal attention to each of her guests; unusual deference is justified only by advanced age or distinguished rank.

A lady who is not in her own house does not either rise on the arrival or departure of ladies, unless there is quite a difference in age; in which case she should, as attention to the aged is one of the marks of a true man or woman which is never neglected by the thoughtful and refined; and lastly, when you have once risen to leave, do not, unless for good reasons, be persuaded to prolong your stay.

It has been well said that "attention to the little forms of. politeness is a proof at once of self-respect, and a respect for your friends." However irksome at first, these trifles soon cease to be matters of memory, and become mere things of habit, and a pleasure to exercise; to the thoughtful or thoroughly well-bred they have become a second nature. No one will neglect, then, little courtesies, who is at all desirous of creating a favorable impression on those with whom he comes in contact, and let no one think them unworthy of attention, for be it remembered that "trifles make perfection, and perfection is no trifle."

VISITS.

When about to make a visit, be perfectly certain that it will be agreeable to those for whom it is intended.

A general invitation to visit should not be accepted. "Do come and spend some time with me," unless the date be added or the time stated, although said with all cordiality, too often means nothing but empty courtesy, and should be replied to by, "I should be happy to," or words to that effect, the matter dropping there.

A definite invitation should be given thus: "Come next Saturday and stay a week with me"; or, "I shall expect you the first week in August to come and spend a month with us."

In all cases when you contemplate a visit, even to relatives, it is courtesy to write and announce your coming, giving as nearly as possible the time of your arrival and the probable length of your stay.

Guests are bound by the rules of hospitality to conform to the habits and customs of those at whose house they are visiting. They should not object to the hours at which meals are served, nor should they allow the family to be kept waiting on their account. Endeavor to hold yourself at the disposal of those in whose house you are stopping.

If they propose to ride, walk, or to otherwise occupy the day, you may take it for granted that these plans are made with reference to your enjoyment. You should, therefore, enter into them with cheerfulness, doing your best to make the occasion an enjoyable one by heartily seconding the efforts which are made to entertain you.

It is by no means required that a hostess should spend her whole time in the entertainment of her guests; though the hostess should place all possible means of amusement and entertainment within their reach, as for a portion of the time at least they may prefer to be left to their own devices. It is, then, a good plan for a visitor to retire to his own apartment during the morning, or at least to seek out his own occupation or amusement without seeming to need the assistance of his friends, thus leaving them free to attend to their private duties, as a guest should remember that, however welcome he may be, his presence is hardly desirable at all times. On the other hand, a visitor should never entirely seclude himself and seek his own amusement apart from his host or the family.

Take care to give as little trouble as possible, but do not continually apologize for whatever extra exertions your visit may cause, as you would thus imply that your friends could not entertain you without inconvenience to themselves.

When no time is specified, a visitor should limit his stay to from three days to a week, according to circumstances, his degree of intimacy, and the distance he has come to pay the visit. It is best also to announce, soon after your arrival, the length of time you intend to remain, so that your host can make arrangements accordingly.

A guest should not accept an invitation in which his hosts are not included, and likewise invitations for the family should include its guests. They should, as far as practicable, appear together in public. The guest should never inquire into family affairs, and, if by accident, any private matter of an unpleasant nature should come to the knowledge of the visitor, he must seem both blind and deaf in regard to it, and never refer to it in any way afterwards. He should never make comparison between his friends and any other house; and he should be more careful of his friend's goods than if they were his own, taking care to replace anything of value he may break or injure.

True hospitality dictates that the host shall offer to his guest the best he possesses in the way of food and rooms without regrets, excuses, or apologies.

Always endeavor to make your visitors feel as much at home as possible, not by words alone, but by every act that will tend to make their stay as pleasant as it is in your power to, at the same time concealing whatever trouble they may cause you.

The visitor when taking leave should express the pleasure which has been experienced during the visit, and courteously thank his friends for their labor and trouble in his behalf, and on reaching home notify them of his safe arrival, when he should again speak of the pleasure of his visit, repeat his thanks, and request to be remembered to all the family.

A host should do all within his power to make the stay of his guest agreeable, and should invite him to remain as long as is consistent with his plans and the host's ability to entertain him. But when the time of leave-taking has been once fully decided upon, no obstacle should be placed in the way of his departure, at the same time giving him a cordial invitation to repeat his visit at some future time.

RECEPTIONS.

THE invitations should be sent out from a week to ten days before the date at which the reception is to take place.

The time for arriving is about eight o'clock, and for departure between eleven and twelve. The lady and gentleman both receive their friends standing near the centre of the parlor. Books, engravings, stereoscopes, photographs, etc., should be placed in a convenient position for the entertainment of guests. Tea, ices, etc., may be served in a separate room, and sometimes at a small reception a regular supper is provided, but this is by no means common.

Introductions are not as general as they must be at balls, though the hostess should take care to see that gentlemen are introduced to such ladies as seem to be disengaged.

The music is usually furnished by the young ladies and gentlemen, who are invited to sing or play by the hostess. And when they can do so, consent should be at once given without excuses or protestations, for those who refuse to sing or assist in making the reception or social gathering a success do an injustice to the parties at whose house they assemble. When it is apparent that all present desire a person to sing, or in any other way add to the pleasure of the evening, it is the duty of the party so requested to perform the part assigned to them. As a rule, if we make an evening's gathering pleasant to others, we will enjoy it ourselves.

Let the music, like the conversation, be adapted to the company, and always remember to be brief in your effort. If your audience desires more they will ask for it. While there is such a thing as intruding too much on good-nature; still if after you have once sung, and it is the general desire of the assembly that you repeat, you should appreciate the compliment paid you and do as requested. It is the duty of the hostess to see that a lady is accompanied to the piano, that the leaves of her music are turned for her, and that she is accompanied to her seat again.

Some ladies receive their friends upon a certain day in the week, having their cards printed to this effect and circulated among their acquaintances, thus:—

Mrs. A. B. Davenport.

At Home, Wednesdays.

During the winter season at Washington, public receptions or levees are held by the President at stated intervals, at which guests are expected to appear in full dress. The invited guests are presented by one usher to the President, and shake hands with him, and are presented by another usher to the wife of the President, to whom they bow and pass on. These receptions last from eight till ten o'clock in the evening.

On the 1st of January and 4th of July, the President holds public receptions, commencing at noon, at which the foreign ministers present in Washington appear in full Court dress, and officers of the army and navy in full uniform. On such occasions, the President receives first the members of his Cabinet, governors of States, justices of the Supreme Court, members of the two houses of Congress, in the order above named; then the members of the diplomatic corps, who are followed by the officers of the army and navy.

TABLE ETIQUETTE.

The ability to be wholly at one's ease when in company is but the result of proper training, careful observation, and habitual practice. So many little points are necessary to be observed, that except a person be accustomed to regard them, he will be certain to unconsciously commit some error, or at best, to feel or appear ill at ease.

Parents should endeavor to accustom their children, both by precept and example, to be courteous and polite to one another and to observe certain rules of etiquette at the table, thereby avoiding all fear that they will appear rude or ill-mannered when away from home or in the presence of company.

People who are accustomed to take their meals alone should be guided by the rules of etiquette as far as possible, for only by practice can those habits of ease and politeness be acquired which are so necessary and desirable when dining in company.

The family should have their meals at regular hours, and all should be in their accustomed seats when possible, and the same spirit of respectful and kindly deference should mark their intercourse as if strangers were present, and no opportunity should be neglected to perform any act of courtesy that may seem necessary. Let good cheer prevail, and endeavor for the time to forget business and domestic troubles, and to enjoy most heartily the pleasures of the meal.

Good taste will of course suggest that the tablecloth be white and clean, and that the arrangement of the dishes and food be as neat as possible; and perhaps it might be well to add that a few flowers have a most beautiful and pleasing effect in table decorations.

It is well to bear in mind that the knife is intended to cut meat, etc., and should not be used to convey food to the mouth: that is the province of the fork. Pies and pastry, however, are cut with the fork. It shows lack of refinement to grasp knife and fork in the clinched hand and hold them upright on either side of one's plate while eating or talking. A knife should not be put into the mouth, or be used as a plaything while waiting for food.

When desiring the plate replenished, send neither knife nor fork with it, but lay them on a side dish, on a piece of bread, or hold them ; lastly, when the meal is finished, do not cross them, but lay them neatly side by side upon the plate. Of course at hotels or large dinners, the knives and forks are changed with the courses, and the waiter's actions will give the cue.

Let a served plate be passed to one's neighbor, unless he is already provided ; but help one's self first from a dish passed in course. Bread should be broken, not cut, and certainly not bitten nor torn with the teeth. Where a fork cannot be used to advantage, use a spoon.

Should anything unpleasant by chance be found in the food, remove it with as little display as possible, lest the appetite of others be spoiled. Cover the mouth with a napkin held in the left hand, remove the offensive matter with the right, and carefully hide it from view.

Eat slowly and never make a noise, either by smacking the lips or sipping from a spoon. Keep the mouth closed as much as possible while eating. To eat very fast is inelegant, to eat very slowly bears an air of affectation ; try to preserve the happy medium. Americans generally eat too fast, — enjoyment and digestion are improved by conversation and abundant time.

As custom requires the fork to be used, principally, in eating, it is necessary to become accustomed to holding it in the left hand, to avoid change.

Many people have an unpleasing manner of holding the knife, fork, and spoon. Such errors can be corrected by watching closely the actions of well-bred people and doing as they do.

Always lift and pass food to neighbors courteously, and never shove it across the table. Do not insist upon guests partaking of particular dishes, nor ask persons more than once, and never put anything by force upon their plates ; it is ill-bred, though common, to press one to eat of anything.

A gentleman will see that the lady he has escorted to the table is helped as she wishes before he attends to his own dinner, but he should not interfere with the lady on the other side of him. He may ask the lady under his care if she will be helped from any dish offered him, before he accepts or declines for himself, and will issue her orders to the waiter.

A guest must never find fault with any dish placed before him; and to appear to question the quality of the viands by smelling or fastidiously tasting them, is a positive insult to his entertainers. No gentleman will ever criticise a wine or anything offered him, no matter how poor it may be.

Endeavor to keep the cloth as clean as possible, making use of the empty side dishes or edge of the plate for bones or other *debris.* Do not drink from the saucer, or pour tea or coffee into it to cool. Do not rise from the table before the rest, except you ask to be excused.

Never reprove your servants before guests; if a dish is not placed precisely where you wished it to stand, or the order of a course is reversed, let the error pass unnoticed by yourself, and you may be satisfied that it will remain unnoticed by others.

ETIQUETTE OF THE DINNER.

"Cheerful looks make every dish a feast."

INVITATIONS to dinner parties should be sent only to friends who are congenial in their natures and on friendly terms with one another. It is often a difficult matter to know when an unpleasantness exists; but when it is known, the host should see to it that both parties are not invited. Among kindred, it is often advisable to pursue an opposite course, as friendship among relatives is often renewed at another table, where petty differences are of course to be overlooked and forgotten.

That invited guests who have not arrived may not feel slighted, dinner should be delayed a short time beyond the appointed hour.

The tastes of one's guests should be studied, and their preferences considered when known, even if the trouble be increased; such notice will certainly be appreciated.

When married people give dinners, it is not necessary that unmarried ladies or gentlemen should be excluded, but quite the contrary, as their presence will have a tendency to make the conversation less restricted and the guests more informal.

The hostess generally judges of the success of a dinner by the manner in which conversation has been sustained; if it has flagged, it is considered that the guests have been indifferent, and that they have not harmonized.

No one should monopolize conversation unless he wishes to win for himself the reputation of a bore.

Good talkers are invaluable at dinner parties,—people who have fresh ideas and are posted on the topics of the day, and are capable of expressing themselves in a pleasant and agreeable manner are desirable.

Invitations are issued in the name of the lady and gentleman of the house, from two to ten days in advance. They are usually sent by mail, and should be answered as soon as received, as it is necessary for the senders to know who are to be their guests. If the invitation is accepted, the engagement should not be lightly broken, as the non-arrival of an expected guest sometimes produces disarrangement of plans.

FORM OF INVITATION.

MR. AND MRS. SEWALL

Request the pleasure of Mr and Mrs. Lee's

company at Dinner on

Thursday, October 13th, at 6 o'clock.

NOTE.—Sometimes the letters R. S. V. P. are placed upon the invitation. This is taken from the French, "*Répondez s'il vous plait*" (respond if you please); or in other words, state whether you will attend or not.

The acceptance should be worded in the third person, also, and may be sent either by mail or messenger. When declining the invitation, the cause should be briefly and plainly stated, that there may be no occasion for misunderstanding or unpleasant feelings. Invitations to tea parties may be less formal, and take the form of a friendly note. It is not considered proper to say *take* tea, but to *drink* tea with me, or us. The hour generally selected in cities is after business hours, or from five to eight o'clock; in the country it may be an hour or two earlier. To be punctual at the hour mentioned, is obligatory on all; if people are early they are in the way, if too late they annoy the hostess. Fifteen minutes is the longest time required to wait for a tardy guest.

On entering the house where an entertainment is to be furnished, it is the guest's duty to seek and greet the hostess before offering attentions to other persons. Generally, where the parties are acquainted, addressed envelopes may be left on a stand or delivered by a servant, containing cards bearing the names of each couple. If the gentleman be unacquainted with the lady, he should ask the host for an introduction.

Married people generally take precedence of single ones at the table. The rule is to seat the lady conducted to the table on the right hand, but the gentleman attending the hostess should sit at her right, which is the seat of honor. Of course every guest cannot enjoy this privilege, as, when there are many invited, the host assigns the hostess to some favored one, on account of his age, position in life, etc. The other ladies are paired off in the same manner by the host, whose duty it is to arrange the guests in such a way that they will most pleasantly entertain each other. The host, himself, selects the chief lady visitor and leads off. The hostess sees all seated before leaving; therefore, her escort must allow her time to usher her guests to the table.

A person should make himself as useful as possible, and be attentive in supplying the wants of others, especially the ladies, but avoid obtruding such services. Do not make that peculiar sound which some indulge in when taking soup or drinking, as it may be obnoxious and disagreeable to neighbors. Coughing, sneezing, or spitting cannot always be avoided; but much may be done to conserve elegance and propriety at dinner in checking them, and the peculiarities and infirmities of others at the table should be noticed as little as possible.

It is very unpleasant to see meat or a fowl carved ungracefully, yet nothing but practice will enable a person to carve well. Novices in life have a great dread of carving, though it is not so difficult as is usually imagined.

If the unpleasant task be assigned to one who is not familiar with carving, it will be better for him to request some one more experienced to act in his stead, than to run the risk of spoiling the bird and bespattering some lady's dress with the gravy; if he attempt to carve, let him do it with confidence, and he will succeed better, and will consequently give greater satisfaction. It is better to practise at home, and acquire care in such duties before incurring the responsibility at a friend's table.

The latest and most fashionable style of serving dinner is *a la Russe*, or according to the Russian mode. All the food is carved at a side table, and the dishes are brought and taken away by servants, consequently the tables are not cumbered, and there is more room for flowers and other ornaments. The host is relieved from the unpleasant task of carving, and he can devote more time to conversing with and looking to the comfort of his guests. This is a good idea, even where no servants are employed, as the meats can be carved and served in the same manner, thus avoiding much trouble and delay.

Flowers add much to the attractiveness of a dinner, and should be placed upon the table when within the means of the host; in the country, where they generally grow in abundance and are easily obtained, they should constitute the regular table ornament. Artificial flowers are beginning to be used instead of real ones, and though they may be an indication of wealth, there is no good reason for substitution, and the custom should not be encouraged, as, being only an imitation, they lack the fragrance, life, and naturalness which we so much admire in those which nature supplies.

Small stands or casters of pepper and salt should be placed to every two or three guests at least, so that no one may be obliged to wait for means of seasoning, according to his taste, the food which has been furnished.

When seated beside a stranger, an introduction is not necessary for liberty to converse, the fact of occupying seats at the table of a mutual friend being sufficient introduction for the purpose of conversation.

Soup is the first course, and should be accepted by all, even if allowed to remain untasted; if not accepted, you have to await the arrival of the second course. It is better to make a pretence of eating than to act as a spectator to the others. Soup should not be called for a second time, and the plate must not be tilted in order to get the last spoonful.

Fish follows soup, and should be eaten with a fork, unless fish knives are provided. It may be declined, but should not be called for a second time. After this comes boiled dishes and roasts, with side dishes, followed by the dessert. Entrées are the dishes served in the course after the fish.

If one does not desire a dish which is offered, let it be declined with thanks; but it should not be added that the particular article of food is not agreeable.

As soon as the hostess perceives that all have finished, she glances at the lady who is at the right of the host, and all the party rise and leave the dining-room.

On returning to the parlor, the guests mingle in a social manner or engage in various entertaining games, interspersed with music and singing, if desired, remaining generally from two to three hours after dinner. The host should endeavor to have the guests retained by the attractions of the party. To invite a guest to dine is to become responsible for his happiness as long as he remains. To perform this duty faultlessly is not an easy task.

It matters not whether a host be rich or poor, if he invite a friend to dine, he should aim to make him entirely at his ease, as much so as if he were at home. To do this the host must appear contented, not allowing his mind to become ruffled at anything which may happen. He should be frank, open-hearted in manner, and should not extol himself nor apologize for a poor dinner, if it chance to be so. When receiving or entertaining others, a person should strive to forget self and lay aside all desire to shine.

Let all that is possible be done to cause the guests to be pleasing to one another, encouraging the timid, drawing out the bashful, and directing conversation without sustaining it. It is by no means the expensive preparations and the costly dishes which form the most agreeable part of a dinner, but the kind and friendly feelings shown. An invitation should not be declined because one is not able to return it in as fashionable a manner, for true hospitality neither expects nor desires any return.

ETIQUETTE OF BALLS AND PARTIES.

The first requisites for a successful ball are well-ventilated rooms, good music, and plenty of good company.

A room which is somewhat longer than it is broad is the most desirable for this purpose, as in a perfectly square room the dances cannot be so well arranged, while in a long, narrow one only quadrilles or contra dances would be possible. Though nymphs and satyrs may have "tripped on light fantastic toe" over greensward and rocky paths, they probably did not attempt the German; however, at present, preference is given to a smooth hard-wood floor, which, sprinkled with powdered wax, looks well and helps the foot to glide. Carpet dances are not desirable, as they ruin the carpet, which can seldom be stretched tight enough to make a dance pleasant.

Nothing can produce a more pleasing effect than an abundance of shrubs, plants, and flowers placed in the corners and recesses, upon the stairs, and in the hallways.

In Paris, where balls are more elegant than anywhere else, this fact is appreciated, and most beautiful effects are obtained; they may be as freely used here, and be in good taste, even though the balustrades of the staircase and all the fireplaces be woven about and concealed by evergreens and plants in flower.

The French conceal the musicians, and the strains of violin, piano, or flageolet are wafted from behind flowery banks, artfully erected at one side or corner of the ball-room. The head of a ball-room is usually the part nearest the orchestra, and is generally the point farthest from the door. Care in regard to this will often prevent much confusion.

Cloak-rooms are indispensable. The room provided for the accommodation of the ladies should be supplied with looking-glasses and an abundance of hooks, etc., for hanging up the garments. It is well to fasten tickets to cloaks, hats, etc., giving a duplicate to each person, thus avoiding all chance of mistake. In public halls, rooms with attendants are provided for this purpose; and generally a small fee is attached to their use.

Good music is as desirable as good rooms. A piano and violin, of course, form the mainstay of the orchestra. To these may be added a horn or flageolet, and if the rooms are very large, more pieces may be introduced to advantage.

Let the number of guests be regulated by the accommodations, though it is well to invite a few more than are needed, as there will doubtless be some declinations when the appointed evening arrives. If the room be overcrowded it destroys the pleasure of those who are fond of dancing, and to have a ball too numerously attended is fully as uncomfortable as to have too few present.

The invitations are issued, in the name of the hostess, from one to three weeks in advance, and should be replied to immediately.

Guests may arrive at a ball from nine to eleven, but should avoid going too early.

The hostess stands near the centre of the parlor and receives her friends as they enter. They in turn should advance directly to her and tender their respects before stopping to salute any one else.

The list of dances should be so arranged that there will be nearly an equal number of waltzes and quadrilles, with a few contra dances interspersed. For large balls, a printed order of dances is used, with blank spaces left for the names of partners. Usually a ball opens with a march, which is followed by a quadrille, and this, in turn, by lancers, polkas, etc.

It is not required that a lady should be acquainted with the *steps* in order to walk gracefully through a quadrille; a knowledge of the *figures* and an easy carriage only are requisite.

Introductions which are given merely to enable a lady and gentleman to go through a dance together by no means constitute an introduction to friendship, and should not be so regarded.

Be particularly careful not to forget any engagement made, as it is one of the greatest slights that a gentleman can offer a lady.

The supper depends largely upon the means of the host, and hence very little can be said about it. The supper-room is generally thrown open at about midnight and remains open until the ball closes. When the food is provided at home, we should advise that, however simple, it be good of its kind and abundant in quantity. Dancers are usually hungry people and do not readily forgive when the supply of eatables is not equal to the demand. In the hot months, iced drinks, etc., should be supplied in plenty, but partaken of with great caution, and never when heated.

It is the duty of the hostess to see that every one is properly attended to the supper-room, and the same order is observed in going as at dinner parties.

At the end of a dance, a gentleman bows to his partner, thanks her for the pleasure afforded him, etc., and hands her to a seat.

An escort should call for a lady and accompany her to the place of entertainment, leave her at the dressing-room door, and return to meet her when she is prepared to enter the ball-room. He should then conduct her at once to the hostess, dance the first dance with her, lead her to the supper-room, take care that she is supplied with partners for dancing during the evening, and be ready to take her home when she desires to go, and in short show her every possible attention.

In asking a lady to dance, it is sufficient to say, "May I have the pleasure of dancing this waltz with you?" or, "Will you honor me with your hand for this quadrille?" Should she already have a partner, desire her to name the dance for which she is not engaged, and to prevent error, write your name or initials opposite it upon her tablet.

A lady should be careful how she refuses to dance without reason, as there is nothing at which gentlemen more easily take offence. When compelled to, she should make her excuses; and, after refusing one gentleman for a dance, should not consent to participate in the same with another.

It is better not to attempt to dance a figure with which you are unacquainted. In round dances, hold the lady's hand easily at the side, but do not place it behind you, nor raise it high in the air. In quadrilles, a knowledge of the French terms employed is necessary in only the very choicest circles. These are, —

Balancez. — Swing partners.
Balancez aux coins. — Swing corners.
Balancez quatre en ligne. — Set four in a line.
Chaine Anglaise. — Head couples right and left
Chaine Anglaise double. — Double right and left.
Chaine Anglaise demi. — Half right and left.
Chaine des dames. — Ladies' chain.
Chaine des dames double. — Ladies' chain beginning together.
Chaine le grande. — Grand right and left.
Chassez. — Move to right and left or to left and right.
Chassez croisaz. — Ladies and gentlemen *chassez* in opposite directions.
Cavalier seul. — Gentlemen advance alone.
Demi-promenade. — All half-promenade.
Dos-a-dos. — Back to back.
Glissade. — A gliding step
Le grande rond. — All join hands and advance and retire twice.
Le grande tour de rond. — Join hands and dance round figure.
Le grande promenade. — All promenade round figure.
Le moulinet. — Hands across.
Demi-moulinet. — Ladies advance to centre, give right hand and retire.
Traversez. — Opposite persons change places.
Re-traversez. — Cross back to place.
Vis-a-vis. — Face to face.

Be not, while dancing, confined to observations concerning the weather, or the number of people present; but having asked a lady to dance, be as agreeable to her as possible.

At private parties, when arrangements are made for refreshments, offer, at the conclusion of a dance, to escort the lady to partake of them, and should she accept, find her a seat, await her commands, and see that she receives proper attention.

A lady must not detain her partner long in the supper-room, as he may thus be forced to break an engagement for the following dance.

A gentleman should not invite a lady to dance with him unless he has received an introduction to her. At public balls there is usually an officer called the Floor Director, whose duty, with his aids, is to see that all desiring to dance are supplied with partners. At a private party, the hostess and other members of the household attend to this.

Leave-taking, when not general, should be quiet, in order not to attract the attention of the other guests.

And, lastly, since the great charm of a ball or party is perfect accord and harmony, all disputes and loud talking should be avoided; a small matter is sufficient to disturb the peace of the whole assembly.

Each person should contribute as much as is in his power to the enjoyment of others, dance with the plainest as well as with the most elegant, and endure trifling annoyances with cheerfulness.

ETIQUETTE OF THE THEATRE AND CONCERT.

INVITATIONS for the theatre or concert, as has been stated under "Letter Writing," should be written and replied to in the third person.

It is a gentleman's duty to invite a lady long enough before the evening of the performance to be certain of securing pleasant seats, but if they cannot be secured, the party should go early enough to secure good places. Even when seats are secured, it is advisable to be punctual, as it does not look well to be late. A lady should answer a note of invitation as soon as possible, as, by delay, she may keep her gentleman friend in doubt, and deprive him of the pleasure of inviting another friend if she declines.

When entering the hall, a gentleman and lady should walk side by side, unless the aisle is too narrow, and in that case the gentleman should precede, and having reached their seats remain quietly in them. If obliged to leave the seat, politely apologize for the trouble caused.

When accompanied by a lady, always retain the seat at her side; do not go out between the acts, if avoidable. When alone and occupying a desirable seat, cheerfully relinquish it in favor of a lady who needs one. During the entertainment perfect quiet should be observed, though between the acts conversation in a low tone is allowable; but there should be no loud talking, laughter, or anything to attract the attention of others.

CHURCH ETIQUETTE.

"MANNERS make the man," says an old adage, and nowhere is this more true than in public places; yet there are many who, either from ignorance or carelessness, are continually violating some rule of politeness which pertains to places of public assemblies.

And there is certainly no place in which greater regard should be paid to all proper form of decorum than at church. One's demeanor should be such as becomes the place and occasion, remembering that the house has been dedicated to the worship of the Supreme King of kings, and preserving due respect and solemnity while there.

Endeavor to be in season, lest the services may be interrupted by late entering; always remove the hat on entering the church, and do not leave before the services are over. When people are at their devotions, one's manner should be quiet and subdued, lest it disturb them in any way.

At the conclusion of the services do not hurry, but go out quietly. Upon reaching the vestibule, salutations may be exchanged with friends, but let it be done in a mild, easy manner, and never stop upon the steps of the church to engage in long conversations.

When attending church, sit, kneel, or stand with the congregation and pay proper respect to its form of service; even if devoid of all religious feeling, regard the sentiments of others.

It is advisable to see that strangers are provided with books, and should they be aged or unaccustomed to the service, the place for the day's lessons should be pointed out, and every opportunity afforded them to follow the service. Do not turn around to gaze at anybody, or to watch the choir. If desiring to visit a church for the purpose of seeing the edifice, go at a time when there is no service.

STREET ETIQUETTE.

THERE is no place where men or women will so truly display their culture as on the street, in public conveyances, and in travelling generally. The true man is at all times, in all places, and under all circumstances, kind and courteous to all. He regards not only the rights but the wishes and feelings of others, is respectful to every one, and is always ready to extend his aid and services to those who need them.

When a man recognizes a friend on the street in passing, he should lift his hat with the farther hand. Lifting the hat is sufficient recognition between men; but in meeting a lady, an old gentleman, or a clergyman, it is necessary to bow also.

Formerly it was the custom for a lady to recognize a gentleman on the street by a bow before he was permitted to recognize or bow to her, no matter how well they were acquainted, but this custom is fast becoming obsolete. A man may now bow and raise his hat to every lady of his acquaintance whom he meets without waiting for them to take the initiative. If she be a lady, she will certainly respond to his salutations; should she not care to recognize him, her manner at the time will convey her wishes to him, and a sensible man will govern himself accordingly.

A gentleman, in walking with a lady, should offer to carry any parcel she may have with her.

A woman should not usually form acquaintances upon the street, or seek to attract the attention or admiration of the other sex, as to do so might render false her claims to ladyhood, if it did not make her liable to charges of a more severe nature.

When acquaintances, meeting on the street, stop to converse, they should retire to one side so as not to obstruct the passage of others. If a stranger be in company with a friend, an introduction need not, but, as a rule, will be given. The third person should not generally take a conspicuous part in the conversation, but after the introduction observe a respectful silence.

If a gentleman meets another in company with a lady whom he does not know, he lifts his hat to salute them both. If he knows the lady, he should salute her first. A gentleman who accompanies a lady always returns a salutation made to her. If a person wishes to shake hands, he should lift his hat with the left and extend the right hand. Do not extend the left hand unless the right is so engaged that it cannot be used, in which case an apology is in order. In a crowd a man should always precede a lady.

A person should not hesitate in acts of courtesy or politeness through fear that they will not be recognized or understood. One may not be too polite, provided there is no officiousness shown, so long as one conforms to the rules, while it is easy to lack politeness. If courtesy is met by neglect or rebuff, it is not for the courteous, but for the uncourteous person to feel mortified, and all observers will so regard the matter.

A man should shorten his step when walking with a lady or delicate person. A lady, unless in haste, should not walk rapidly with others, as to do so is not graceful or becoming.

In meeting a lady, it is optional with her whether she will pause to speak or not. If a gentleman has any information to convey to her, he should not stop her, but turn and walk in her company until he has said what he wished, then he should leave her with the usual salutation.

Whispering in public, loud talking, laughing, and staring should be avoided, as they are not becoming, are disagreeable to others, and do not tend to advance one in their good opinion.

If a gentleman be about to enter or leave a store, and meet a lady in the doorway, or in a narrow space, he will stand aside, raise his hat, and wait for her to pass. If the door be closed, and she be going the same way as himself, he should pass before her, bow, saying, "Permit me," or, "Allow me to open the door," open it and hold it open until she has passed.

Gentlemen do not stand upon street corners or steps or in doorways and stare at ladies, much less make audible remarks.

In public conveyances, all should endeavor to make room for passengers entering, and no gentleman should retain his seat when there are ladies standing. No lady will accept a seat, vacated by a gentleman for her convenience and comfort, without a smile, a bow, or thanks.

A lady may accept the services of a gentleman who is a stranger to her in entering or alighting from a public conveyance, or in any other case where a gentleman's services are needed, and the lady should in a proper manner acknowledge the favor shown.

To eat anything, even confectionery, in the street, is not good taste.

A man may excuse himself, when on the way to keep an engagement, if he chances to meet an acquaintance who wishes to talk with him. He should, however, do so in a courteous manner, at the same time expressing regrets for being obliged to hurry.

A gentleman should not join a lady acquaintance on the street for the purpose of walking with her, unless he ascertains that his company would be perfectly agreeable. It might be otherwise, and she should frankly say so, if asked; if not, she may, without offending him, convey the impression that his absence is preferred.

Looking back after a person has passed should be avoided. If a lady and gentleman are in a hurry and meet a crowd, a few courteous words will open a passageway quicker than the most vigorous pushing and shoving.

A good rule to follow is, never speak ill of an acquaintance, either in the street or elsewhere; it certainly can do no good and may do much harm. An unknown relationship may exist between the friend with whom conversing and the one mentioned. If nothing good can be said of a person, the better way is not to speak of him.

A woman, wishing to cross the street, should not run across to avoid an approaching carriage, but should wait until it passes. If the street be crowded, as in cities, a policeman's services may be requested. To attempt to cross between the carriages of a funeral procession is rude and disrespectful. The foreign custom of removing the hat and standing in a respectful attitude until the melancholy train has passed, is a commendable one, and should be followed in this country.

Always keep to the right of the sidewalk, and turn aside, if necessary, to give room to one carrying a heavy bundle, or to a lady. In a rain-storm a man should not carry an umbrella when with two ladies, but should give it to the ladies, as, if he carries it, the ladies are sure to get wet, while he takes the lion's share of the protection the umbrella affords.

On inquiring for goods at a store, do not say, "I want to buy," or, "I want such and such an article," but, "Please show me such an article." Do not examine an article which is under the examination of another person, but wait until its inspection is finished. Do not offer an opinion when meeting a friend who is purchasing goods; one's opinion will have more weight if given when requested. Do not interrupt friends while they are making an inspection or purchasing goods, but wait until they have leisure. Use no deception when buying goods; be honest with the salesman, and as a rule he will speak the truth.

Avoid trying to beat down if the prices do not suit. Say they are unsatisfactory, or, better still, say nothing about it, but go elsewhere. Do not tell the salesman that prices are better in another place, but go there to make the intended purchases. Ladies should not take up the time of a salesman in outside conversation, while others are present who desire to be waited upon.

ETIQUETTE OF RIDING AND DRIVING.

RIDING and driving are conducive to the best kind of physical development. They impart a vigor to the body and mind, and one accustomed to horseback riding is almost sure of having a well-developed and healthy appearance. Riding is a remedy often prescribed by physicians to those who have a weak or broken-down constitution.

The etiquette of riding is very exact and important. The left side, when in the saddle, is called the near side, the right is called the off side. Remember to always mount on the near side. In doing this, put the left foot in the stirrup, the left hand on the pommel of the saddle, the right upon the cantle, then in vaulting throw the right foot over the horse's back.

Remember, that it is a rule of the road, both in riding and driving, to *keep to the right.* If this rule be not observed, and through negligence an injury be received, probably nothing can be recovered; whereas the other party, if injured, may have a good cause of action.

It is well to take lessons at a riding school, if it can be afforded, before appearing in public. The first experience in a saddle is not always a very graceful or pleasing one. If not in a riding school, practise in private, until accustomed to managing a horse, and study the rules of horseback riding.

In riding with ladies, recollect it is a duty to see them in their saddles before mounting. Assist them to mount, and see to the security of the saddle and bridle. The assistance they require should not be rendered by a groom; his duty should be to hold the horse's head.

The lady will place herself on the near side of the horse, her skirt gathered up in her left hand, her right hand on the pommel, keeping her face towards the horse's head. Stand at the animal's shoulder facing her, and stooping, hold the right hand so that she may place her left foot in it; then lift it as she springs, so as to aid her. When safely seated, place her foot in the stirrup and smooth the skirt of her habit, and do not leave her side until she feels perfectly at ease, and has her reins and whip in order.

Keep to the right of the lady or ladies, provided they are good horsewomen; but if the ladies are inexperienced it is better to ride between them, to render assistance if necessary.

The lady should give the pace, as no gentleman will ride faster than she may find agreeable, or try in any way to display his own horsemanship.

Do not turn a corner at full speed, lest some one be injured by a collision. Always look in the direction in which moving, lest perchance some mishap occur.

In assisting a lady to enter a carriage, a gentleman should see that the skirt of her dress is not allowed to hang outside, that a carriage robe is provided to protect her dress from the mud and dust of the road, and that she is comfortable in every way before he seats himself. When leaving the carriage, the rule is that a gentleman must alight first and hand the lady out. The carriage should be driven close to the sidewalk, with the right side of the carriage nearest it, and the horses turned so as to spread the wheels. When the gentleman alights he should hold the reins in his right hand, as a guard against accident. The lady should, in leaving the carriage, place her hands on the gentleman's shoulders, while he should place his under her elbows; then, with his assistance, she should spring lightly to the pavement, passing him on the left, to avoid the reins which he holds in his right hand. In driving, a gentleman should place a lady on his left. This leaves his right hand free to manage his horses.

A gentleman should not drive fast if the lady accompanying him be timid, or objects to it. He should consult her wishes in all things and take no risks, as he is responsible for her safety. He should not race with another team, and should consult her wishes while with him.

DRESS.

It is the duty of every man and woman, by giving proper attention to matters of dress, to make themselves pleasing in appearance, not only for their own good, but that the feelings of others may not suffer by the presence of one who disregards all the usual taste and judgment in selection or care in matters of dress. We may very often be deprived of participating in affairs that would be to us a source of much pleasure and enjoyment through negligence in this respect. A person who may be invited to participate at a party or dinner should afford a presentable appearance; otherwise he may be an object of ridicule, and his friends will estimate the respect the man may have for them by the appearance of his attire.

Suppose a gentleman should present himself to escort a lady to the opera or theatre with soiled clothes, shaggy beard, and muddy boots, would she not have reason to be indignant and perhaps feel insulted? and precisely the same rule applies to ladies.

It will readily be seen that it is a duty which every member of society should give proper attention to. Extremes in matters of dress, as in everything else, are to be avoided. We should not sacrifice equally important duties to excel in this; by such a course more may be lost than gained. The desirable end is to present a tasteful and creditable appearance. To accomplish this, it is not necessary to indulge in lavish expenditure and useless waste of time and material. A careful compliance with the rules of dress does not imply anything of the kind. We leave ourselves liable to adverse criticism as much by making a gorgeous display as we do by neglect. While excellent taste may be shown in the selection of our clothing, a simple feature may spoil the effect of the whole; thus how often may we see a man with long, pointed shoes, which curl up towards his face, or broad-brimmed hat, though he be otherwise faultlessly dressed, attention will be attracted by the contrast, — the defect will be more noticeable. The same may be said of ladies, who, by their high-heeled boots and enormous hats, etc., render an otherwise beautiful costume ridiculous.

The prevailing idea is, that by adopting the style that *fashion* may dictate, we are doing all that is required. This is a mistake. A certain style of garment makes its appearance as the latest from the *modiste.* It is instantly seized upon, simply because it is the "latest style," the fact that it may become only those of a given height or complexion being entirely ignored. It is safe to say that people, by following their *own* idea of what may be suited to them, would leave themselves less liable to censure.

To fulfil the requirements which society demands on different occasions, and to have ourselves arrayed in harmony with the surroundings in which we may be placed, is the object of the following rules: —

COLOR. — The first thing to consider is the color, and in this particular more mistakes are made than in any other. One must be guided by his or her complexion. This is an essential requisite to the proper fulfilment of the laws governing harmony of color. A person of low stature may adopt light colors which would not become one of taller proportions. The latter will appear to better advantage in dark.

Colors may harmonize either by contrast or similarity. One having been chosen that is suitable to the complexion, care should be taken to have the trimmings of one analogous shade, as using contrasting shades might deprive the dress of its favorable effect. Should a color be adopted that is not in harmony with the complexion, the defect may in a great measure be remedied by associating with it contrasting colors, as one alone predominates, and the rest should set it off. Black may be said to be an exception to all others, as it is always becoming, regardless of a person's complexion. White, also, is favorable to brunettes. A person of delicate complexion will appear to best advantage in light and delicate tints. For a ruddy countenance and fair hair, blue is becoming. A person's age should be taken into consideration in determining the tint to be worn. Dark shades are appropriate to middle-aged and old people, while the light and gay will be found desirable for young folks. Below will be found a table that forms combinations suitable to various tastes, and which may assist in making selections, though the tendency is in the direction of one material and shade for dresses: —

Black and scarlet.
Black and cardinal.
Black and lilac.
Black and pink.
Black, old gold, and blue.
Black and maize.
Black and cardinal (shaded).
Black and brown
Black and white (perfect).
Black and slate.
Blue and white.
Blue, green, and orange.
Blue and gray.
Blue and orange (perfect).
Blue and purple.
Blue, orange, and black.
Blue and scarlet.
Blue and chestnut.
Blue and gold.
Crimson and gold.
Crimson and purple.
Crimson and orange.
Crimson and drab.
Crimson and maize.
Crimson and brown.
Chocolate, gold, and pink.
Cardinal, black, and brown.
Cardinal and dark blue.
Garnet, pink, and bronze.
Green and yellow.
Green and orange.
Green and cardinal.
Green and gold.
Green and scarlet.
Green, scarlet, and blue.
Green, mulberry, and gold.
Lilac and cherry.
Lilac and gold.
Lilac and crimson.
Lilac and scarlet.
Lilac, crimson, and gold.
Lilac and maize.
Lilac and gray.
Lilac, scarlet and black or white.
Light pink and garnet.
Myrtle and bronze.
Myrtle, yellow, red, and blue.
Myrtle and old gold.

Mulberry and bronze
Mulberry and gold.
Mulberry and pearl.
Orange, crimson, and blue.
Orange, crimson, and lilac.
Orange, purple, and scarlet.
Orange and chestnut.
Orange, green, and red.
Orange and brown.
Peacock blue and light gold.
Peacock blue and cardinal.
Peacock blue and old gold.
Purple and orange.
Purple and maize.
Purple, scarlet, and white.
Purple and gold.
Purple and white.
Purple and black.
Red and gold.
Red, green, and orange.
Red and white or gray.
Sapphire and old gold.
Sapphire and blue.
Sapphire and garnet.
Sapphire and pink.
Sapphire and cardinal.
Sapphire and bronze.
Scarlet and orange.
Scarlet, blue, and white.
Scarlet, white, and black.
Scarlet, blue, and yellow.
Scarlet and slate.
White and pink.
White and cherry.
White and scarlet.
White and crimson.
White and brown.
White and gold.
Yellow and red.
Yellow and black.
Yellow and purple.
Yellow and blue.
Yellow, purple, and crimson.
Yellow and crimson.
Yellow and violet.
Yellow and white.
Yellow and chestnut.
Yellow and lilac.

These colors may be used in various modifications of shade and harmonize, but that is left to individual taste. Artificial light changes the effect of many colors, and the complexion will stand colors at night that it will not by day.

MATERIAL. — When about to purchase goods for garments, reference should be had to the purpose they are intended to serve, and care should be taken to select such quality and style as is adapted to the individual; thus, goods of a heavy rich pattern are better suited to a tall, full figure, than to a short person, as on the latter they may look baggy and badly shaped.

Persons of short stature should be content with meagre attire and subdued colors. Striped goods are to be avoided by very tall and slim people, as it will make them appear taller still, and give the body an awkward appearance; while those of a more diminutive size may adopt them to good advantage.

Large figures and patterns in goods, especially when worn by short persons, indicate a want of taste. Neither should tall persons adopt them, as, united with the figure, a flashy appearance may be acquired.

By a little attention given to matters that may appear to be trifling, but which are really necessary, these mistakes may be avoided, and a habit acquired of doing that which good taste would indicate.

"All affectation in dress," says Chesterfield, "implies a flaw in the understanding." One should, therefore, avoid being singular, or attracting the notice and the tongues of the sarcastic, by being eccentric.

Choose those garments which suit you and look well upon you, irrespective of the fact that a lady or gentleman in the same village or street may excel you in goods or style.

When dressed for company, strive to appear easy and natural; nothing is more distressing to a sensitive person, or more ridiculous, than to see a lady laboring under the consciousness of a fine gown, or a gentleman who is stiff, awkward, and ungainly, in a brand new suit.

Dress according to your age. It is painful to see an old lady dressed as a belle of four-and-twenty, or a man, old enough to be a grandfather, affecting the costume and the manners of a beau.

Young men should be well dressed, not foppishly, but neatly and substantially, and never beyond their means; it is poor policy to try to dress in the latest style when one's means are limited. No one should spend all his earnings as fast as received, for accident or illness might then make him an object of charity.

A gentleman's apparel should be neat, his linen clean, and his boots well blacked. He should generally wear only such jewelry as is useful.

A lady should not be lavish in the display of jewelry or ornament, and should avoid the use of strong perfumes, as they will be noticeable and may be disagreeable to others.

Although mankind is prone to judge people by the clothes they wear, still we have the consolation of knowing that the people whose opinions are worth considering do not take this as their criterion, as they will always consider a person's associates, manner, and speech, before deciding as to his character.

A safe rule is always to preserve a medium course in dress, as well as in demeanor, and in all cases to avoid extremes.

CONVERSATION.

All men and women are not gifted with the happy faculty of being brilliant talkers, or of being able to express themselves in elegant or forcible language. Nevertheless, there is no good reason why those who are accustomed to society, or those who desire to be in it, should be ignorant of the rules of polite intercourse, or fail to master all the customary forms of address.

When in the company of others, those matters which are of interest to persons addressed should be made the subject of converstion, rather than one's own affairs. Avoid politics, religion, and all other topics likely to excite argument.

Do not drag in the names of distinguished persons to whom related, or who may be personal friends. One should not speak of his own exploits, nor give illustrations of his prowess and capacity.

Control any desire to shine, and be most particular not to monopolize the conversation. It is presumptuous in any person ever to attempt to lead it.

Avoid whatever is personal in tone or allusion; neither flatter nor make observations of an offensive character, — false constructions may be placed on the words, or those taken in earnest which were spoken in jest.

Do not speak in a loud voice, or assume a dictatorial manner. If any statement is made which is known to be incorrect or untrue, be very careful of the manner in which correction is made. Do not accuse the speaker of having made a wilful misstatement; suggest a correction rather than make it. If the point in question be immaterial, it will be better to let it pass unnoticed. When addressed in an offensive manner, or in an objectionable tone, it is as well not to notice it; either pass it over at the time, or take the most convenient opportunity of withdrawing from the company. A "scene" or a quarrel is above all things to be avoided.

Do not use French or other foreign languages in general conversation. When quotations from foreign languages are used, the translation should also be given. One should not speak as if desiring to display learning. Slang phrases are to be avoided. Every profession has its own technical terms and set of expressions, which should be used only when in the society of persons of that profession. Many common words, when used in the technical sense of a profession or trade, convey a different meaning from the ordinarily accepted one, and when used in general are apt to be misunderstood.

Be careful not to interrupt a person while speaking, and should he hesitate for a word, do not hasten to suggest one. No one knows as well as the speaker what he intends to say. The word supplied may be entirely out of place, and instead of assisting the speaker he may become all the more embarrassed.

Do not whisper in company, or converse in any language with which all present are not familiar, unless foreigners are present who do not speak the common tongue. Should a stranger enter the room and the conversation continue after his arrival, it is only just to inform him of the nature of the conversation, and to give him an idea of what is going on.

Refrain from using curt or short answers in ordinary conversation. In replying to questions like the following: "Do you know when Mr. Spalding is to be married?" "I did not ask," is like saying, "I never ask impertinent questions." It is better to say, "I do not know," "I have heard nothing about it," or words to that effect.

Express yourself simply and clearly. Avoid all attempts at elegance or show. Use the shortest and plainest words possible, and when done stop. Speak in a distinct voice; avoid loud talking. A low, soft voice is one of woman's greatest charms, and one which never fails to win the admiration of men.

Mothers should beware of praising or talking much of their children in company. Such topics, though interesting to themselves, are not likely to be so to others. Mere courtesy will keep visitors from expressing a different opinion, but they will be glad to change the topic. Be cautious in relating anecdotes. Unless one can tell a story with good effect, he should not attempt it. Laughing at one's own wit should be avoided. Constant relators of anecdote are apt to become great bores.

Do not mimic the peculiarities, infirmities, or shortcomings of others, as it may give offence to some one present who is a friend of the person imitated. It is not proper for one to speak of what passes in a house that he is in the habit of visiting.

One need not tell all the truth, unless to those who have a right to know; but let all spoken be truth. Do not offer advice unless it is likely to be followed. Be cautious in asking questions, as otherwise the person with whom the conversation occurs may be unintentionally embarrassed. Do not volunteer information; and, especially in public, be very sure the facts stated are correct. Do not sit dumb in company, but bear a share of the general conversation. Do this with modesty and self-possession, neither being forward nor hesitating when required to speak. It is better to be a good listener than a good talker; and it may appear rude to ask a person to repeat, as it usually indicates inattention.

The greater one's learning, the more modest should be the manner of showing it. When we speak of ourselves and another person, whether he be absent or present, propriety requires us to mention ourselves last. Thus, we should say, "He and I," "You and I," etc.

Avoid exaggerated expressions. Speak simply and with moderation, or men may doubt true statements. Always be good tempered; nothing is so agreeable or so useful in society as a pleasant, even temper. Avoid disputes and arguments in the presence of others; it generally indicates a small mind. When a statement is advanced which is believed to be untrue, do not say, "Sir, you are wrong"; or, "I know you are mistaken." If a correction be made, let it be in as pleasant and agreeable manner as possible; for instance say, "I beg pardon, but I understood it was," etc. If in doubt in relation to the matter, say nothing about it.

Be lenient to the weaknesses and defects of friends, and never parade them before the public view.

COURTSHIP.

PEOPLE of either sex, especially those who have arrived at mature age, have the greatest freedom in their social intercourse in this country, and young people are at liberty to associate and mingle with those of the opposite sex much more freely than in Europe. As soon, however, as a young man neglects all others to devote himself to a single lady, he gives that lady reason to suppose that he is particularly attracted to her, and may give her cause to believe that she is the object of his affections, even though he fail to give expression to his sentiments in words; consequently, a man who does not contemplate matrimony should not pay too much attention to any one lady.

A young lady should not allow special attention from any one for whom she has no particular regard, because she may do injury to the gentleman in seeming to give his suit encouragement, and she may by her actions keep away from her those whom she likes better, but who will not approach her under the mistaken idea that her feelings are already interested.

A young lady ought not to encourage the addresses of a gentleman unless she feels that she can return his affections. It is the privilege of man to propose and of woman to accept or refuse. A kind-hearted girl or woman will give her suitor some hint before he reaches that humiliating stage of making a proposal which must result in a refusal.

Where a man and woman agree to devote their lives to each other, it is very important that they should make no mistake in the selection. The greater part of the troubles of the married spring from a neglect to comply with this law. Persons who are in no way suited to each other rush into matrimony and pass their lives in repenting their error.

The choice of a wife should be a matter of love and affection. No outside collateral relations should be allowed to have any influence on the mind. Wealth, social position, or the influence of friends should be set aside. If respect and love for the lady chosen, and her reciprocation of these feelings, exist, then any or all outside influences will work no injury. If, on the other hand, the marriage occur for any cause other than love for one another, then the union will be liable to be an unhappy one.

No one should make great efforts to persuade a woman whom he loves, but who may not love him, to marry him. He should remember that he will likely be much more miserable with her, under the circumstances, than without her.

Let all marry voluntarily and assume the responsibility, great as it may be, for themselves; and after taking due counsel and fully weighing all arguments and conditions on both sides, finally decide it according to the best judgment they can bring to bear on the subject.

When a young man feels a fondness arising in his mind for a young lady, he should hold it in check until he can ascertain who and what she is. A lady, wreathed in smiles and moving with cautious effort to conceal defects of temper or of intellect, can soon acquire an irresistible influence over the mind of a lover, unless he be well on his guard. It will be far better for him to stifle his affection at the beginning, if he discover her unfitness to be his wife, than to go on heedlessly and bear the life-long agony of an imprudent marriage. In like manner, the paramount question with every young lady, concerning the man who is paying her particular attention, should be, "Is he worthy of my love?" and her first aim should be to decide this question, carefully and honestly, by studying his character, observing his appearance and conduct, and inquiring, if she does not already know, into his history, standing, and parentage.

It is, of course, impossible to lay down any specific rules for the selection of a husband or wife, but it will be useful to attend to a few general principles.

Do not marry a person not known long enough to learn his or her character, habits, and disposition. To marry upon brief acquaintance is, as a general rule, a mistake. As a rule, a man should not marry till he is twenty-five, nor a woman till she is past twenty. A man should be his wife's senior by a few years.

It is better to marry a person of similar religious convictions. Decided differences of faith are apt to divide families and to produce great trouble in after life. A pious woman should beware of marrying an irreligious man. Sickly persons should not marry persons similarly afflicted, and should not marry until their health improves sufficiently, or unless they have reason to believe that it will be improved thereby. A healthy girl should not marry a man in bad health. Besides burdening herself with the care of an invalid, she is apt, in a short while, to be left a widow.

A wife cannot bring a greater fortune to her husband than good health; and so with the husband. A woman should not marry a man of dissipated habits; above all, if these habits are confirmed, as only sorrow and misfortune await such a union.

Do not fear to marry a poor man or woman. Married life, as a rule, is passed more happily among the poorer than the richer classes. Good health, cheerful dispositions, stout hearts, and industrious hands will bring happiness and comfort. It is contrary to the laws of health to marry within certain degrees of kindred, such as cousins, etc.

PECULIARITIES TO BE GENERALLY OBSERVED. — 1. Those who are medium in complexion, stature, etc., — who are not very dark or light, large or small, tall or short, — should marry those who are medium or nearly like themselves in these respects.

2. Bright red hair and florid complexion indicate an excitable and impulsive temperament. Such a man should marry with a woman of dark hair and complexion, and *vice versa*. The lighter one's hair and complexion, the darker should be the other's.

3. Where one has features which are pronounced, he should marry a woman of decidedly different features. Marriage should be among, not only those who are different in complexion, stature, and features, but those who have different traits of character, or whose dispositions are different. Thus, a small, nervous, active man could not expect to live happily with a nervous little woman.

When a young man has become acquainted with a young lady whom he would like to make his wife, and their acquaintance has been such that he thinks the young woman loves and respects him, at the proper time and place, and in language chosen by himself, he should ask her to become his wife. No book can give a satisfactory formula of words to be used, and if it were attempted, the formula would seldom be used; besides it would savor of the ridiculous. "Out from the heart the mouth speaketh." The language should be in keeping with the person, and he will thus appear to better advantage and be more apt to receive a favorable reply than if giving utterance to a set form of words from a book.

If a woman has no affection for a man, and does not think it possible to entertain any, it is cruel to give her person without her love. If she does not accept his offer, then he should not press his suit further. If a woman really means "no," she should say it so as to make her meaning understood. If she desires the suit ended, her refusal should be positive, yet she should be kind and dignified, so as to spare the feelings, as much as possible, of the man who was willing to take her as a partner upon the road of life. A woman who boasts of a rejected offer should never receive another chance to do so.

ENGAGED.

The conduct of the engaged couple towards each other should be tender, unobtrusive, and kind. The gentleman should be friendly and polite to the sisters of his betrothed; yet not too familiar, or try to force his way into the confidence of the family. Let the advance come from them, who should look upon him as a member of the family, and let him show a due appreciation of the confidence which they may place in him.

The family of the young man should make the first advance toward an acquaintance with his future wife. If within a reasonable distance, they should call upon her; if not, they should write to her, and they may with perfect propriety invite her to visit them in order that they may become acquainted.

The young woman should avoid all flirtations, though it is not necessary that she should cut herself off from all association with the other sex because she has chosen her future husband. She may still have friends and acquaintances, but a young lady should conduct herself towards all others so as not to give offence to her affianced.

A young man has no right to offer insult to his future bride by appearing in public with other women, while she remains neglected at home. He is her legitimate escort, and should not act as such to others. She in turn should respect him, and accept no other escort, nor appear in public with another, when he is at liberty to attend her.

There is always a chance of "a slip between the cup and the lip," and a young man or woman should not be too demonstrative or affectionate while engaged; as if, perchance, the "slip" should come, it might not be agreeable to think of in the future.

Neither party should attempt to test the other's feelings by giving cause for jealousy; and if either actually becomes jealous and breaks off the engagement, the offending party only receives a just punishment. No young man who really respects his future wife will assume a domineering air over her; if he does, she will do well to escape from future misery by breaking the engagement before she becomes his wife in reality.

Engaged lovers should study the dispositions and tastes, and try in every way to enhance the pleasures and happiness of each other. These little attentions which show affection, and which cost nothing in themselves, and are a source of so much pleasure to the engaged, should never be neglected.

A ring, which may be as handsome as the gentleman wishes to procure, is the first present in order after an engagement.

Before engagements, presents should not be costly, though trifles suggestive of good-will and esteem may be given. After the engagement the gentleman can be more generous, only he should never be extravagant. The lady is at perfect liberty to return the compliments, or to show her esteem in some other manner.

WEDDINGS.

"With wise instinct Nature seems
To harmonize her wide extremes,
Blending the stronger with the weak,
The haughty with the soft and meek."

THE circumstances under which marriages take place are so varied, and the forms to be observed are so numerous, that it would be impossible to give them all in a work like this, though we will give a few of the leading formulas as examples, any one of which may be followed with perfect propriety:—

After the wedding invitations have been issued, the young lady does not generally appear in public till the wedding day.

Only relatives or the young lady's nearest friends are asked to be bridemaids. Where there are sisters of the bride and bridegroom they are generally asked. The bridegroom chooses his best man and the other groomsmen and ushers from his circle of relatives or friends of his own age; he may also ask those of his *fiancée* of a suitable age. As a rule, each one furnishes his or her own clothes for the occasion.

The most approved bridal costume for young brides is of white silk, a long white veil reaching to the feet, and a wreath of maiden-blush roses with orange blossoms. The blossoms are worn only during the ceremony, but the roses may be worn afterwards. The bridegroom, best man, groomsmen, and ushers wear black dress suits, frock or swallow-tail coats, though light pants may be worn, white or lavender neckties (satin preferred), and white or lavender kid gloves. They may also wear a button-hole bouquet. The gloves and ties should be of the same shade.

The bridegroom and the groomsmen may come to the church, or the bridegroom and his relatives, in the same carriage. Generally the groomsmen and bridemaids come in the same carriage. The bridegroom or groomsmen should pay the cost of this carriage.

The bride's parents provide the carriage for themselves and bride. A more recent custom is for the bridegroom and best man to call with a carriage for the bride and bridemaid. If there are other bridemaids and groomsmen, it is well for them to be at the bride's residence in their carriage at an appointed hour, and all proceed to the church together. The advantage of this is that all will reach the church at the same time, and there will be less confusion and delay than if they came at different times and in separate conveyances. If the bride, bridegroom, groomsmen, and bridemaids come in different carriages, those arriving first should await the others in the vestibule of the church.

Upon the arrival of the bridal party, the ushers will meet them in a body at the door, and precede them up the centre aisle of the church. Upon reaching the altar they will separate to the right and left, and take their places in the rear of the bridal party.

Upon the entrance of the bridal party within the doors of the church, the organist may play a "Wedding March," and as the members take their places at the altar, can change this to low, subdued, but sweet and appropriate strains, which may be continued through the services. The front of the church should be reserved for the friends of the contracting parties.

On entering the church, the best man or groomsman should lead the bride to the altar, and the bridegroom should escort the bridemaid. The groomsman should stand on the right-hand side of the bridegroom, the bride on his left, and the bridemaids on her left. The bride should remove her left-hand glove and give it to the bridemaid. The second last of the left hand is, and always has been, the ring finger.

At the proper time, indicated by the clergyman, the best man is to produce the ring and hand it to the bridegroom, who places it upon the book. After the ring is placed on the bride's finger, the bridegroom holds the ring while the clergyman says, "With this ring," etc.

The ceremony consists of but a few words generally, though it differs with the various sects, each denomination having a favorite form, the proceedings being varied to suit the taste or circumstances. The clergyman usually says, "John Henry Brown, are you willing to take Maria Gilbert to be your lawful, wedded wife?" whereupon John Henry says, "I am." He then asks Maria the same question, substituting the word "husband" for "wife," and her answer should be the same.

During the ceremony, the bride, bridegroom, best man, and bridemaid should endeavor to act with grace, maintain self-control, and not get nervous or excited. If anything unexpected happens, make as little display as possible, and do not get confused. The officiating clergyman will always direct what to do.

At the conclusion of the service, the bridegroom gives his right arm to the bride, leading the way to the vestry, followed by the rest of the party. There it is customary for him to raise the bride's veil and kiss her; and his example is frequently followed by the groomsmen and some of her most intimate friends.

It is considered bad form for the young couple to recognize acquaintances when leaving the altar by bowing or smiling. As a mark of respect, the guests should remain standing until the bridal party passes out.

When the circle of friends on both sides is very extensive, it has become customary of late to send invitations to such as are not called to the wedding, to attend the ceremony at church. This stands in the place of issuing cards. Those who receive neither cards, when sent, nor an invitation to the church ceremony or to the dinner, should not call on the newly married couple.

When there are no bridemaids or ushers, the marriage ceremony is as follows: —

The members of the bride's family proceed to the church before the bride, who follows with her mother. The bridegroom awaits them at the church and gives his arm to the bride's mother. They walk up the aisle to the altar, the mother falling back to her position on the left. The father, or relative representing him, conducts the bride to the bridegroom, who stands at the altar with his face turned towards her as she approaches, and the father falls back to the left. The relatives follow, taking their places standing; those of the bride to the left, those of the groom to the right. After kneeling at the altar for a moment, the bride, standing on the left of her affianced, takes the glove from her left hand, while he takes the glove off his right hand. The service then begins. The father of the bride gives her away by bowing when the question is asked, which is a much simpler form than stepping forward and placing his daughter's hand in that of the clergyman.

There are many who prefer the fashion of our grandmothers, which is almost strictly an American one. In this style the bridemaids, each leaning upon the arm of a groomsman, first pass up the aisle to the altar, the ladies going to the left and the gentlemen to the right. The groom follows with the bride's mother, or some one to represent her, leaning on his arm, whom he seats in a front pew at the left. The bride follows, having her father as an escort. The father waits at her left, a step or two back, until asked to give her away, which he does by taking her right hand and placing it in that of the clergyman. After this he joins the mother of the bride in the front pew, and becomes her escort while they pass out of the church.

Weddings at home or in the clergyman's house differ but little from those described; the difference is that they are more simple and shorter. The positions of the bride and bridegroom, bridemaids and groomemen, are essentially the same.

The groomsman should remember to have with him: 1. A marriage certificate. 2. The ring. 3. Clergyman's fee. 4. The bride. At the wedding reception, if there be one, congratulate the bridegroom, as *he* is supposed to have won the prize; but offer good wishes to the bride for her future welfare.

Should the circumstances of the case compel the bride to be married in travelling-dress, the ceremonies will be as simple as possible. The newly married couple in such cases generally repair from the church to the depot or steamer and start upon their bridal trip.

The wedding tour should be definitely arranged in advance of the marriage, and the tickets purchased before the ceremony, so that there may be no delay or confusion upon the arrival of the bridal party at the depot. The bride's wishes should govern the choice as to the route. Haste and bustle should be avoided. Plans should be so arranged that the journey may be one of comfort and pleasure. Accommodations in the hotels where stops are to be made should be secured in advance.

It is best that the young couple should make the wedding tour unaccompanied by any of their friends. It relieves them of embarrassment, and enables them to devote themselves entirely to each other.

GEORGE WASHINGTON'S MAXIMS.

Every action in company ought to be with some sign of respect to those present.

In the presence of others, sing not to yourself with a humming voice nor drum with your fingers or feet.

Speak not when others speak, sit not when others stand, and walk not when others stop.

Turn not your back to others, especially in speaking; jog not the table or desk on which another reads or writes; lean not on any one.

Be no flatterer, neither play with any one that delights not to be played with.

Read no letters, books, or papers in company; but when there is a necessity for doing it, you must not leave. Come not near the books or writings of any one so as to read them unasked; also look not nigh when another is writing a letter.

Show not yourself glad at the misfortune of another, though he were your enemy.

In visiting the sick, do not presently play the physician if you be not knowing therein.

In writing or speaking, give to every person his due title according to his degree and the custom of the place.

Strive not with your superiors in argument, but always submit your judgment to others with modesty.

Undertake not to teach your equal in the art he himself professes; it savors arrogancy.

When a man does all he can, though it succeeds not well, blame not him that did it.

Being to advise or reprehend any one, consider whether it ought to be in public or in private, presently or at some other time, also in what terms to do it; and in reproving show no signs of choler, but do it with sweetness and mildness.

Mock not nor jest at anything of importance, break no jests that are sharp or biting, and if you deliver anything witty or pleasant, abstain from laughing thereat yourself.

Wherein you reprove another be unblamable yourself, for example is more prevalent than precept.

Use no reproachful language against any one, neither curses nor revilings.

Be not hasty to believe flying reports to the disparagement of any one.

In your apparel be modest, and endeavor to accommodate nature rather than procure admiration. Keep to the fashion of your equals, such as are civil and orderly with respect to time and place.

Play not the peacock, looking everywhere about you to see if you be well decked, if your shoes fit well, if your stockings set neatly and clothes handsomely.

Associate yourself with men of good quality if you esteem your reputation, for it is better to be alone than in bad company.

Let your conversation be without malice or envy, for it is the sign of a tractable and commendable nature; and in all cases of passion admit reason to govern.

Speak not of doleful things in time of mirth nor at the table; speak not of melancholy things, as death and wounds; and if others mention them, change, if you can, the discourse. Tell not your dreams but to your intimate friends.

Break not a jest when none take pleasure in mirth. Laugh not aloud, nor at all without occasion. Deride no man's misfortunes, though there seem to be some cause.

Speak not injurious words, neither in jest nor earnest. Scoff at none, although they give occasion.

Be not forward, but friendly and courteous, the first to salute, hear, and answer, and be not pensive when it is time to converse.

Detract not from others, but neither be excessive in commending.

Go not thither where you know not whether you shall be welcome or not. Give not advice without being asked; and when desired, do it briefly.

If two contend together, take not the part of either unconstrained, and be not obstinate in your opinions; in things indifferent be of the major side.

Reprehend not the imperfections of others, for that belongs to parents, masters, and superiors.

Gaze not on the marks or blemishes of others, and ask not how they came. What you may speak in secret to your friend deliver not before others.

Be not apt to relate news if you know not the truth thereof. In discoursing of things that you have heard, name not your author always. A secret discover not.

Be not curious to know the affairs of others, neither approach to those who speak in private.

Undertake not what you cannot perform, but be careful to keep your promise.

When you deliver a matter, do it without passion and indiscretion, however mean the person may be you do it to.

When your superiors talk to anybody, hear them; neither speak nor laugh.

In disputes be not so desirous to overcome as not to give liberty to each one to deliver his opinion, and submit to the judgment of the major part, especially if they are judges of the dispute.

Speak no evil of the absent, for it is unjust.

Set not yourself at the upper end of the table; but if it be your due, or the master of the house will have it so, contend not, lest you should trouble the company.

When you speak of God or his attributes, let it be seriously, in reverence and honor, and obey your natural parents.

Let your recreations be manful, not sinful.

Labor to keep alive in your breast that little spark of celestial fire called conscience.

HOUSEHOLD.

> "The Household is the woman's realm,
> And love's magic wand her sceptre;
> A husband and her children's love, her throne;
> And a million duties well performed, her crown."

THERE is no more important theme upon which the mind of man or woman can be employed than that of the household. Its influences for good or evil have no equal.

The *Church* may teach, and the *State* command; but, if the household be not under proper control and surrounded by moral influences, the precepts and commands, in a great measure, will go for naught.

Hence it is that, whatever may be said or done that will tend to elevate the tone, and thereby improve the conduct, of a household, has a beneficial effect on the community in which it exists.

A well-regulated household is a blessing, not only to its own members, but to every one fortunate enough to enter within its portals; for it gives an example which will not fail to produce good results.

The attributes of a model home are INTELLIGENCE, ORDER, ECONOMY, and CHEERFULNESS; and there is no place on earth where these qualities are more essential than in our home, and nowhere do these jewels shine with greater brilliancy, or command more immediate or warmer commendation.

A sensible woman realizes that, when she enters the marriage state, she is *bound by every principle of right and duty* to devote herself to the advancement of her husband's interests, and that in no other way can she so surely secure her own happiness in this life, or in the life to come. She will see at once that her first duty is to make her husband's home all that the name implies; for any woman that has a heart knows that there is a vast difference between a *home* and a dwelling-place. *The true woman* will, whether she lives in a palatial residence or a laborer's tenement, do all in her power to make her household a bright and cheerful home.

No family can be happy that is being continually pressed by creditors. To avoid this state of affairs, the woman of brains will endeavor to live within her means.

The foolish woman will take great pleasure in making display, and will not stop to think of the waste she is making of her husband's means. No! She will sacrifice comfort, home, children, husband, everything, on the *altar of display;* and her gain for all this is the contempt and criticism of those for whose good opinions she did so much, and the condemnation of those for whom she did so little.

To be economical we must of necessity have *order;* that is, we must have *a thorough systematic way of doing everything:* there must be a place for everything, and everything must be in its place when not in use.

The woman who will follow this rule will find she will have time to spare; and the reason is, that whatever is done in a methodical manner is done properly, and in less time than if it were done in the haphazard style so common among careless housekeepers.

An economical woman will keep all things about her house in order, as they will last longer when thus arranged; and it behooves us all to take proper care of what we have, whether they are cheap or costly.

ORDER, to be maintained, necessitates a careful watchfulness over the minor affairs of the household. Where we find an intelligent housekeeper, we will also find an orderly and an economical state of affairs; and there also will be found that *cheerfulness* which encourages the father in his endeavors to better the condition of his family, and that skill and ingenuity which stimulate his brain to plan and strengthen his arm for the execution of his plans.

It is with an earnest desire to assist the good wives and daughters, who desire to make home happy, that we offer the suggestions contained in the following pages, and we trust they may be found useful. Many of the recipes require little, and none great, expense.

DUTIES OF THE HOUSEKEEPER. — Upon the proper and timely discharge of the housekeeper's duties depend all the comforts of a good home. The first duty of the housekeeper is to institute and maintain a systematic way of performing routine duties; for by so doing she will economize her time, temper, and strength.

KEEPING ACCOUNTS. — A knowledge of resources is the first requisite; hence the housekeeper should take an inventory or list of all that she has in the house, and enter the same in a book kept for the purpose; and in this same book she should also enter all the money which she receives, and the amount of every expenditure which she makes, as well as the purpose for which it is made. In this way she will be able to tell at any time just what she can afford to lay out for each department.

When a woman keeps a strict account of her household expenses, she furnishes an incentive to her husband to do likewise with his affairs; and, besides placing herself in a position to help and advise her husband in his business, she is qualifying herself to take his place should he be taken from her; and her example will find fruition in her children, for they will become accustomed to having matters carried on in a systematic way, which will be of great value to them in years to come.

In the *Bookkeeping Department* of this work will be found a system of keeping accounts, so simple and yet so explicit that any woman will readily understand it; and, if so inclined, she can keep a set of books for the house with very little more trouble than would be necessary for keeping one book, and to greater advantage.

A BOOK OF WANTS should also be kept, in which should be entered everything that is wanted for the house, to the end that nothing may be forgotten that is needed.

Everything should be ready for immediate use when required. System will result in a sweet-tempered husband, and prevent the possibility of a homily from him regarding shiftlessness.

A wise woman will do without even necessaries rather than borrow from her neighbor.

A model housekeeper will always be too busy to attend to the affairs of her neighbors, unless charity demands her aid in cases of affliction.

The perambulating gossiper or newsmonger will find no welcome from an intelligent housewife, for she will remember that "*the dog that brings a bone will carry one.*"

THE MANAGEMENT OF SERVANTS. — In selecting a servant, pains should be taken to inquire carefully into her antecedents. The attributes of a good servant are *honesty* and *simplicity* (in manner, speech, and dress), *good health*, and a *cheerful disposition.*

The woman who is fortunate enough to be able to employ and *pay* a servant ought not to be above seeing that the servant performs her duty in a proper manner; and, while treating her as a human being, she should not be allowed to rule the house with the rod of a despot. The one whose will directs the affairs of the household is its mistress, by whatever name she may be called; therefore it is essential that the employer should insist on having her instructions carried out to the letter and without remarks, unless desired.

In order to retain the respect of subordinates, it is necessary to know *what* ought to be done, and *when* it is done properly.

In giving instructions, try and make them clear and explicit and never deem servants stupid because they fail to grasp ideas at once.

A superior should be able to instruct if necessary.

A wise woman will not reprove her servant or children before company, as the woman who does so only serves to make herself ridiculous and to create sympathy for the culprit.

Arguments in the household are out of place; especially is this true as between mistress and servant.

Control the passions, for manifestation of anger tends to loss of dignity and influence; but, when reproof is necessary, it should be administered in as mild, yet firm a manner as possible: point out where the fault lies, and how it may be avoided in the future.

Accidents are no respectors of persons: they happen to mistress and maid alike; when they occur, and are *not* the direct result of carelessness, they should be passed over as quietly and kindly as possible.

Unnecessary fault-finding will ruin the best home, and for this reason is to be avoided. Still, a good housekeeper will not permit any important breach of duty to go unnoticed.

Never allow a servant to talk about the private affairs of others; for such liberty has injurious reaction. The behavior of the servant is a matter which concerns the mistress, but her religious belief is not; and a self-respecting woman will never interfere in such matters.

Neatness is essential; for a slovenly woman is an abhorrence to the eyes of man, and especially is this true in a man's own home, whether the woman be his wife or servant.

FAMILY MEALS should be ready at regular hours, and each member of the family should be present when practicable. The custom of having a family take its meals just when it pleases its individual members will not be tolerated by a judicious housekeeper in her own house

We will now consider the most interesting combination known as —

FOOD.

MILK is almost the only substance which is regarded as a naturally prepared food. It supplies every requisite for the body, and may be considered the most perfect food that exists in nature; therefore we should endeavor to imitate the composition of milk in the preparation of our diet.

Table Showing the Chief Flesh-forming Foods.

Animal.	Vegetable.		
	Flesh-forming materials exist largely in —		
Lean meat.	Peas.	Flour,	Made from wheat.
Fish.	Beans.	Macaroni,	
Poultry.	Lentils.	Semolina,	
Skim milk.	Oatmeal.	Rye.	
Cheese.	Barley.	Corn.	
White of egg.			

Table Showing the Chief Warmth-giving Foods.

Fats.		Starch.		Sugar.
		Found in		*Found in*
Cream.	Suet.	Flour.	Rice.	Sugar-cane.
Butter.	Dripping.	Potatoes.	Semolina.	Beetroot.
Oil.	Lard.	Arrowroot.	Tapioca.	Honey.
Yolk of egg.		Corn-flour.	And most garden vegetables.	Fruit.
				Milk.

Now, there are some articles of diet which contain neither of the above qualities in proper proportions; hence it is economical, as well as desirable, to supply the deficiency in one article of food by using another with it that supplies what is lacking. Thus, potatoes alone are barely able to support life, and they cannot sustain health and strength, but, eaten with milk, they are good; and for this reason pork and beans are cooked in unison, and bread and butter go hand in hand.

These subjects and others on food are treated of in the Medical Department of this work.

Food in Season for every Month of the Year.

January. — House lamb, mutton, beef, pork, venison.

Partridges, hares, rabbits, woodcocks, snipes, grouse, wild fowl, turkeys, capons, pullets, fowls, chickens, tame pigeons.

Carp, perch, eels, haddocks, herrings, sprats, dace, pike, soles, cod, flounders, plaice, sturgeons, smelts, lobsters, crabs, oysters, shrimps.

Cabbages, savoys, coleworts, brocoli, sprouts, onions, beet, sorrel, spinach, celery, garlic, potatoes, parsnips, turnips, shallots, lettuces, cresses, carrots, forced cucumbers, mustard, rape, herbs of all sorts dry (and some green).

Apples, pears, nuts, walnuts, grapes, oranges.

February and March. — Meat (except venison); fowls, with the addition of chickens and ducklings; and game, as in January; fish, as in December and January, except that cod is not thought so good from February to July.

Vegetables, the same as January, with the addition of kidney beans, apples, pears, walnuts, grapes.

April, May, and June. — Beef, mutton, veal, lamb, venison.

Pullets, fowls, chickens, ducklings, green geese, pigeons, rabbits, hares.

Soles, smelts, eels, trout, lobsters, salmon, herrings, mackerel, crabs, shrimps, flounders, oysters, perch, skate, shad, pike.

Early potatoes, peas, radishes, kidney beans, carrots, turnips, sprouts, spinach, celery, cucumbers, onions, early cabbages, cauliflowers, asparagus, artichokes, all sorts of salads forced.

Strawberries, raspberries, cherries, rhubarb, melons, apricots, currants, gooseberries, peaches, pineapples, oranges, and bananas

JULY, AUGUST, AND SEPTEMBER. — Beef, mutton, veal, lamb, venison.

Pullets, fowls, chickens, rabbits, pigeons, green geese, leverets, turkey poults. Two former months, plovers, geese.

Salmon, trout, cod, haddock, flounders, skate, pike, carp, herrings, eels, shell-fish (except oysters); mackerel and salmon, the first two months of the quarter.

Beans, peas, French beans, potatoes, cauliflowers, mushrooms, vegetable marrows, etc.

FRUIT. — In July, strawberries, gooseberries, pineapples, plums (various), cherries, apricots, raspberries, melons, currants.

AUGUST AND SEPTEMBER. — Peaches, plums, figs, filberts, mulberries, cherries, apples, pears, grapes; latter month, pines, melons, strawberries, quinces, cherries, damsons, and various other plums.

OCTOBER. — Meat as in last month, with the addition of doe venison, and pork.

Domestic fowls as in former quarter, pheasants, partridges, hares, wild ducks, teal, snipes, grouse.

Smelts, pike, perch, halibut, carp, salmon, trout, bloaters, cod, shell-fish.

Vegetables as in January, French beans, last crops of beans, etc.

Peaches, pears, figs, grapes, apples, medlars, damsons, filberts, walnuts, nuts, quinces.

NOVEMBER. — Beef, mutton, veal, pork, lamb, doe venison.

Poultry, with the addition of teal and pigeons; fish and game as the last month.

Carrots, turnips, parsnips, potatoes, onions, cabbages, savoys, spinach, beets, cresses, celery, lettuces, salad, herbs, pot herbs.

Pears, apples, nuts, walnuts, chestnuts, grapes.

DECEMBER. — Beef, mutton, veal, house lamb, pork, venison.

Geese, turkeys, pullets, pigeons, capons, fowls, chickens, rabbits, hares, snipes, woodcocks, larks, pheasants, partridges, sea-fowls, guinea-fowls, wild fowls, ducks, and grouse.

Cod, halibut, soles, sturgeons, carp, pike, skate, perch, codlings, eels, bream, shell-fish.

Vegetables and fruit as in the last month.

MARKETING. — A good and thrifty housewife will, if possible, go to market herself, in order that she may obtain that experience which is necessary to select the best pieces, and get them at the lowest price. It is better generally to trade at one place. If you are not a judge of meat, say so, and rely on the dealer's honesty.

A housewife will vary the kinds of meat which she buys, not only as they may be suitable to the seasons, but as calculated to promote the health of the family; and, to aid her in buying the proper food, we offer the following suggestions as to the choice of meat: —

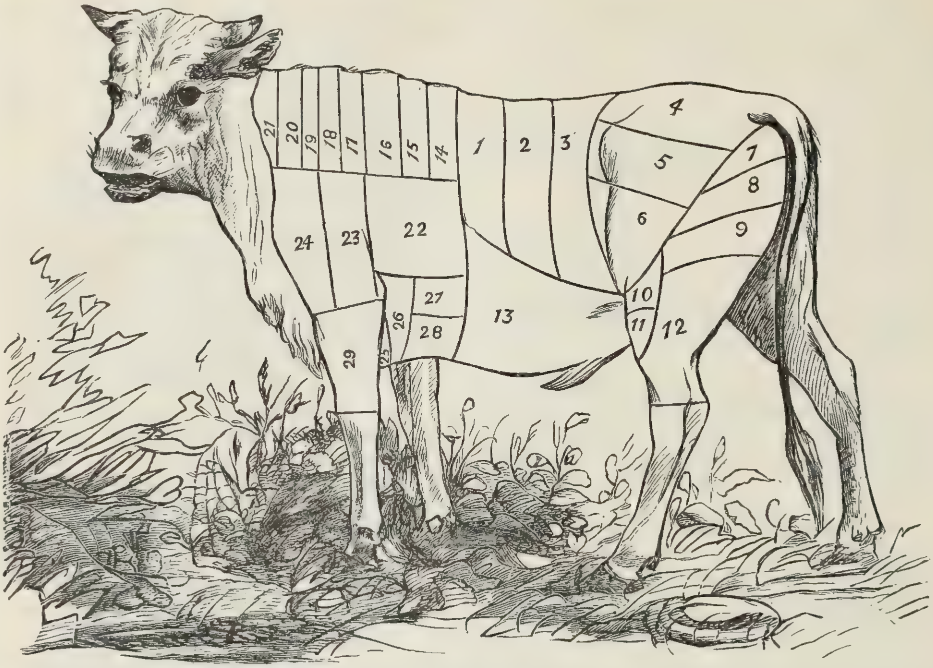
BEEF. — The grain of ox-beef, when good, is fine; the lean red; the fat firm, and inclining to yellow. Cow-beef has a closer grain, a whiter fat, and the lean of a paler red. Inferior beef, from old, ill-fed animals, has hard, skinny fat, or dark-red lean. *Prime meat pressed by the finger rises up quickly; when the dent made by pressure returns slowly or remains visible, the meat is of inferior quality.* Of all meats, beef is the most nutritious and economical. The tenderness of meat may be tested, and any taint detected, by forcing a skewer into it.

As it may be interesting to the cook to know how a side of beef is cut up, and what the names of the different parts are, we give an illustration of a steer marked as the butcher would dissect it, on the following page.

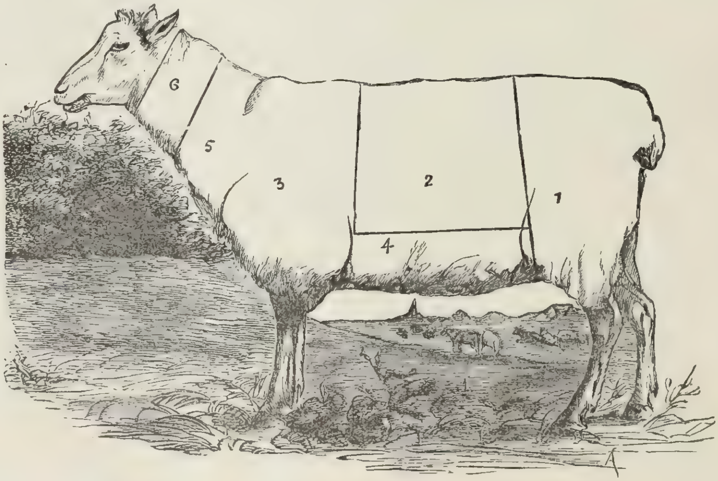
Clear beefsteak is cheaper than that which contains bone; therefore tenderloins, rumps, and round steaks are the cheapest. The *top* of the round steak is the most nutritious part of the beef.

Meat never should be placed directly, or wrapped in paper and put on the ice. When cooked, it should be perfectly cool before being put away.

MUTTON. — Good mutton is very nutritious, and is comparatively easy of digestion. Coarse, stringy mutton, with little fat, should be avoided. Mutton is not cheaper than beef,



1, Tip of Sirloin; 2, Second Cut of Sirloin; 3, First Cut of Sirloin; 4, Back of Rump; 5, Middle of Rump; 6, Face of Rump; 7, Aitchbone; 8, Prime Round Steak; 9, Inferior Round Steak; 10, Prime Vein Piece; 11, Inferior Vein Piece; 12, Shank; 13, Flank; 14, Rib, First Cut; 15, Rib, Second Cut; 16, Rib, Third Cut; 17, Best Chuck Rib; 18, Poor Chuck Ribs; 19, Poorer Chuck Rib; 20, Poorest Chuck Rib; 21, Neck; 22, Rattle Ran; 23, Shoulder; 24, Sticking Piece; 25, Shin End of Brisket and Sticking Piece; 26, Brisket; 27, Middle Cut or Rib-Plate; 28, Navel End of Brisket; 29, Shin.



In the above cut, 1, 2, and 4 comprises the Hind Quarter, and 3 and 5 the Fore Quarter, and the several parts are named as follows: 1, The Leg; 2, The Saddle or Loin; 3, The Shoulder; 4, The Flank; 5, The Breast; 6, The Scrag End.

though it be lower priced. Its fat cannot be used to advantage in cooking, because of its strong flavor. Lamb is more juicy than mutton; its bones are smaller; and, when young, quite red.

Mutton should be firm, close in grain, and reddish, with the fat white and firm. If too young, the flesh feels tender; if too old, on being pinched it wrinkles up. In young mutton, the fat readily crumbles; in old, it is held together by strings of skin.

VEAL should be a delicate pink, though it is often juicy and well-flavored when rather dark in color. White veal is suggestive of unnatural bleeding, and should not be used. If the fat round the kidney be white and firm-looking, the meat is prime, and recently killed. Veal will not keep so long as an older meat; when deteriorating, the fat becomes soft and moist, the lean flabby, spotted, and spongy. The fillet of a cow-calf, preferable to that of a bull-calf, is known by the udder, and by the softness of the skin. Veal is neither digestible nor nutritious.

LAMB will not keep long after it is killed. The large vein in the neck is bluish in color when the fore quarter is fresh, green when becoming stale. In the hind quarter, if not recently killed, the fat of the kidney will emit a faint smell, and the knuckle will have lost its firmness.

PORK. — When good, the rind is thin, smooth, and cool to the touch, and the fat white and hard; when changing from being too long killed, it becomes flaccid and clammy. Enlarged glands in the fat, called kernels, are marks of an ill-fed or diseased pig. Small or medium-sized pork is generally better than the large.

BACON AND HAM should have a thin rind, the fat firm, the lean a clear red, without intermixture of yellow. To judge of the state of a ham, plunge a skewer into it right to the bone; on drawing it back, if particles of meat adhere to it, or if the smell be disagreeable, the ham is not good. A small ham is to be preferred.

VENISON.— When good, the fat is clean, bright, and of considerable thickness. To know when it is necessary to cook it, plunge a knife into the haunch, and from the scent the cook must determine accordingly on dressing or keeping it. In summer it is usually kept ten days after killing; while, in winter, keeping it three weeks is none too long.

TURKEYS AND POULTRY. — The age of the bird is chiefly to be considered. An old turkey has rough and reddish legs, a young one smooth and black. When fresh-killed the eyes are full and clear and the feet moist. When it has been kept too long, the parts about the vent have a greenish tinge. Poultry, when young, have the legs and combs smooth; when old they are rough, and on the breast are long hairs instead of feathers. Fowls and chickens should be plump on the breast, fat on the back, and white-legged. In all fowl under nine months the tip of the breast-bone is soft; after that age it becomes hard.

GEESE. — Bills and feet are red when old, yellow when young. When fresh-killed, the feet are pliable, stiff when too long kept. Geese are called *green* while they are only two to four months old.

DUCKS. — Choose them with supple feet, and hard, plump breasts. Tame ducks have yellow feet, wild ones red. The canvas-back, Mallard, and Red-head are the most popular.

COD, as all other fish, is known to be fresh by the rigidity of the flesh and fins, the redness of the gills, and the clearness of the eyes. Crimping much improves this fish. Cod is not as nutritious as the darker fleshed fish, but is easier to digest. Avoid soft and sunken-eyed fish of any kind.

Salmon. — Flavor and excellence depend upon its freshness, and the shortness of time since it has been caught; for no method can completely preserve the delicate flavor it has when just taken out of the water.

Halibut is one of the best of food-fishes, and its flesh has a pearly-white tint when fresh: the medium-size fish is the best.

Haddock is not so strong in flavor as the cod, but is very much like it: the haddock has a *light* mark on both sides, and the cod a *dark* one.

Mackerel must be perfectly fresh. Spanish mackerel are larger, and have yellow marks on their sides instead of lines.

Shad is sweet, but full of bones. Epicures are fond of its roe.

Herrings can only be eaten when very fresh, and, like mackerel, will not remain good very long after they are caught.

Bluefish is dark, and quite rich in flavor.

Fresh-water Fish, including trout, pike, perch, etc., present the same indications of being fresh or otherwise as previously stated.

In Lobsters the tail preserves its elasticity if fresh, but loses it as soon as it becomes stale. When light, lobsters are watery and poor.

Crabs have an agreeable smell when fresh, chosen by observations similar to those exercised in the choice of lobsters.

Prawns and Shrimps, when fresh, are firm and crisp.

Terrapins are very expensive, and are used mostly in the South. They belong to the turtle species. They are of three kinds; viz., diamond back, little bulls, and red fenders.

Oysters, when fresh, have their shells firmly closed; when the shells are open they are dead and unfit for use; from May to August they are soft and milky, and of poor quality.

Clams and Quahaugs are nearly the same: the first has a thin, and the latter a thick, shell and round in form. When using clams during the summer, the dark-colored substance found in the body must be taken out before using.

PRESERVING FOOD.

Meat should be carefully examined every day in summer, wiped dry, and such parts as are beginning or seem liable to taint, particularly kernels, removed. In hot weather it may be kept for several days more than it otherwise would, by wrapping around it a linen cloth moistened with vinegar, or equal parts of vinegar and water: the acid vapor keeps off flies, and the moisture causes cold by evaporation. Fresh charcoal bruised to powder has also the property, spread over the meat, of preventing it from spoiling for some time. Meat, when but slightly tainted, may be recovered by boiling it for some minutes with several pieces of fresh charcoal.

Fish should be kept in a very cool place, — an ice-house, if possible; but, if that is not available, they should be laid upon a stone floor or shelf, and dipped in cold salt-and-water every night and morning. If it be necessary to keep them a few days longer, immerse them in a pickle of vinegar and water.

Vegetables, as cabbages, and other vegetables of a soft nature, quickly lose their natural juices by evaporation from the leaves, which soon become flaccid and poor. As heat causes them to lose their juices, they should be kept in a cool, shady, and damp place, *not* in water, as that injures their flavor. The best method of refreshing them is to cut off a portion of the stem, and set the cut part in water. They should not be laid together in heaps, since this is apt to generate heat and fermentation.

Preserving Eggs. — As eggs are produced in large numbers in spring and summer, it is desirable to preserve them for winter use. They may be kept good for many weeks by closing the pores of the shells, by rubbing them with a little melted lard as soon as they are laid; or they may be packed in a vessel and a mixture of freshly slaked lime in water, mixed to the thickness of thin cream, poured over them. This method will keep them, if fresh when laid down, for many months, but it unfortunately renders the shells very brittle.

TABLE OF HOME MEASURES.

2 teaspoonfuls........make 1 dessertspoonful.
2 dessertspoonfuls...... " 1 tablespoonful.
1 heaped tablespoonful of solids is about 1 oz.
About 9 tablespoonfuls of liquid make ½ pint.
A pinch is about the eighth of a teaspoonful.

1 pint of water......................about 1 lb.
1 " " milk........................ " 1 "
2 cupfuls of sugar.................. " 1 "
2 " " butter.................... " 1 "

PREPARATION OF FOOD.

Our food is generally prepared by roasting, baking, broiling, frying, braizing, boiling, or stewing; and each of these operations should be so conducted as to prevent, as far as possible, any loss of the nutritious elements of which the food is composed. The juice of flesh contains many substances of the greatest value as food, and the meat from which it is extracted is of little benefit. Salt meats are not so good as fresh for this very reason, — the *salt extracts the juice, which is the life of the meat.*

Roasting is a mode of cooking meat that is common in this country. It is, however, *not* an *economical* or advantageous mode of cooking *small* joints, as they become dried up; and it is exceedingly wasteful in the case of sinewy or tendonous pieces of meat, as it renders a very large proportion of them quite uneatable. Consequently it is not the best suited to the circumstances of the working classes.

When a piece of meat is hung before a fire, part of the fat melts and forms the dripping, which should be carefully and cleanly preserved, as it constitues a valuable article of food. During the process, some of the water of the juice of the flesh is dried up: from these two causes the meat loses in weight. In some fat joints, more than one quarter of the weight is lost; in others much less, as in the case of a leg of mutton, which is covered by skin, and has little fat to melt away.

To roast well, the meat should be hung up before a brisk, bright fire, the first effect of which is to harden the albumen in the outer parts, and thus prevent the escape of the nutritious juices. The heat should then be continued until it has penetrated the inside. When it is heated the natural red color of the flesh is changed; and, from the hardening of the albumen, the meat becomes firm and can be cut in thin slices.

UNDERDONE MEAT *is not*, as is generally supposed, more nutritious than that which is properly cooked.

In roasting, it is important that the meat should be put down before a bright, clear fire, sufficiently large to heat the whole of the joint at once. Skewers and spits should not be thrust into the meat, as they make holes through which the gravy escapes. The time usually allowed for roasting is a quarter of an hour or twenty minutes for every pound; but this depends on the thickness and size of the joint.

The best plan for making GRAVY for roast meat is as follows: Collect the dripping in a flat pan, and add as much meat as may be required for making the gravy; then dredge in some flour, and place the pan over the fire or stove until the flour is browned; mix a little cold water with the flour, leaving no lumps, pour in a sufficient quantity of boiling water, or broth made by stewing scraps of bones of the joint, and stir the mixture well, allowing it to boil for a few minutes, and pour over the joint. In this manner a large quantity of very good, rich, nutritious gravy is produced, which is very economical, as it renders potatoes and other vegetables much more acceptable, especially to children, and saves the consumption of meat.

If a joint is to be eaten cold, it is better that it should not be cut whilst warm, as the contraction of the fibres forces out the juices; but, if not cut until cold, the juices are retained, and the meat is tender and more palatable.

BAKING is a more economical mode of cooking than roasting, especially in small families. In baking there is *less loss* of weight than in roasting, as the joint is less dried. Care should be taken that the floor of the oven is not too much heated, or the fat may be burnt, which causes a bad flavor. A great advantage in baking is that it requires less attention than roasting, and that potatoes, or a batter or Yorkshire pudding, can be cooked under the meat. This latter may be made by taking four tablespoonfuls of flour and rubbing them into a smooth batter with a pint of milk which has previously had a well-beaten egg mixed with it. If eggs are abundant, two or three may be employed with advantage, the quantity of flour being lessened. The milk and egg must be added gradually, the batter being rubbed until uniformly smooth after each addition.

BRAIZING signifies a slow process of simmering or stewing over a gentle heat. Braized beef is made usually by taking a piece of boneless meat (though the bones would improve the gravy if taken out of the meat and put in the pan under it), and larding the same with salt pork. Put some slices of pork in the pan, and, when it begins to fry, add one onion, one quarter carrot, and one quarter turnip chopped fine, for every four pounds of meat. When these are cooked a light-brown color, put in a bunch of sweet herbs; then dredge your beef with flour, pepper, and salt, and put it on top, let it get brown, throw in water enough to half cover it, and let it *simmer* for four hours. Baste every fifteen minutes.

BROILING is the rapid cooking of a small piece of meat, as a chop or a steak, by exposing it to the heat of a fire: the gridiron on which the meat is cooked is placed over a large, clear fire. It has very nearly the same effect on meat as roasting.

The meat should be rapidly turned, so as to prevent the juices escaping. A fork should not be thrust into the flesh, as it makes holes through which the juices escape.

Broiling is a good mode of cooking thick, fleshy chops and steaks, but is a wasteful method of preparing thin pieces, such as are often purchased when cheap meat is required.

Broiled meat should not be *sprinkled with salt until after it is cooked;* and it should never be cut into in order to ascertain whether it is done, as, if again put down to the fire, the juice escapes from the cut, and the meat becomes dry and much less nutritious.

Frying is the cooking of meat in melted fat heated in a frying or stew pan over a fire or stove.

If the frying-pan is placed over an open fire, the fat is usually overheated, and gives out a very disagreeable smell. Meat, when placed in overheated fat, has its fibrine hardened and contracted, so that it becomes very tough; therefore fried meat is usually regarded as inferior to such as is broiled.

If, however, the fat is not overheated, and there is sufficient to prevent burning, and to cover the piece to be cooked, meat may be fried of a very light brown color without being hardened.

Boiling may be performed in various modes. If the joint be put in *cold water* and placed on the fire, and the heat very slowly raised to the boiling point, and if then the saucepan be pulled back from the fire so as to be kept hot, *without boiling*, until the joint is thoroughly done, the meat will be tender in proportion to the length of time and slowness with which it has been cooked; but a considerable proportion of the gelatine and albumen will be dissolved in the water, and, unless this be used for soup or broth, will be wasted.

This dissolved albumen coagulates or hardens as the water approaches the boiling-point, and forms the scum, which should be removed by skimming just before the water boils, or it is carried down by the boiling and discolors the meat.

A different mode of boiling is sometimes adopted when the liquor is not required for soup. It is to place the joint in perfectly *boiling water* for a quarter of an hour; this hardens the outside, and prevents the escape of the nutritious juices; the water is then cooled, either by adding a quantity of cold water, or by drawing the vessel back from the fire, and the process continued at a *low heat* until the whole is thoroughly cooked.

If the water boil *during the whole time* the meat is cooking, the fibrine will become hardened, and the meat tough and stringy. Avoid sticking a fork or skewer into meat while boiling: a string will answer for a skewer.

Stewing is more economical than boiling. This process will make tough meat more tender and eatable. It consists in submitting the meat to *a long-continued and gentle heat;* and great care must be taken not to allow the heat to rise too high.

Steaming. — In steaming, the food to be cooked is placed in a tin or earthenware vessel, covered with a tight cover or greased paper. The vessel is placed in a pan of boiling water, which comes half-way up its side. If the water boils away, more *boiling* water must be added. Puddings, etc., when steamed, do not require to have so much liquid in them as when baked. The dry air of the oven dries them; steaming keeps them moist.

SOUPS.

Although many of the following soups can be made with water, *they will be richer and more nourishing* if, instead of water, they are made with the liquor in which meat has been boiled, liquor from the stockpot, stock made with a few cooked or uncooked bones, or gravy left over from stews. The flavor of soups may be inexpensively varied by any of the following herbs used seperately, or a sprig of each of several of them may be tied together in a small bunch and put in the soup, and removed before serving: Sorrel, parsley, sage, mint, thyme, marjoram, and bay-leaf. Celery-seed is also a pleasant flavoring and inexpensive. About half a teaspoonful may be used, tied loosely in a piece of muslin, and removed before serving.

Stockpot. — Put into a stockpot all odd scraps of meat, cooked and uncooked, which cannot be used otherwise; pieces of skin; bones (chopped into small piece), cooked or uncooked. Cover with plenty of water, simmer slowly but steadily beside the fire. This should furnish material for sauces and soup; pieces of bread, cold vegetables, remains of sauces, etc., should be used up to thicken and flavor it. In winter the stockpot should be entirely cleared out once a week, and in summer twice a week.

Pan Kail. — *Required:* 1 oz. barley; ¼ turnip; 1 leek; ⅓ small cabbage; ½ carrot; ½ oz. dripping; 3 pints water; ½ teaspoonful of salt; ¼ teaspoonful pepper; 2 teaspoonfuls sugar.

Cleanse the vegetables. Wash the barley in several waters and soak it for two hours in water, then put it into 1½ quarts of cold water with the dripping, pepper, and salt. While the water is heating, chop the cabbage and onion together, put them into a bowl and pour boiling water over them; cover the bowl, and let them stand ten minutes. This draws out the indigestible part of the green vegetables. Pour away this water; chop the turnip and half of the piece of carrot. As soon as the water with the barley in it boils, skim it carefully, and add all the chopped vegetables gradually. Let the whole boil slowly for about two hours, being careful not to let the boiling cease. When it is about half cooked, grate the other half of the piece of carrot; add this and the sugar. If the kail is too thick, and you wish to add water, be sure that the water added is boiling.

Broth. — Make it in the same way as pan kail, but take 2 quarts of water instead of 1½; and, instead of dripping, put in some bones, or small pieces of neck of mutton, or a piece of beef, or a well-cleansed sheep's head. If a sheep's head be used, not less than 4 quarts of broth should be made, with vegetables in proportion. It takes at least four hours to cook. When you take it out of the broth sprinke over it some bread raspings, put some little bits of dripping on it, and brown it before the fire.

Potato Soup. — *Required:* 1 lb. potatoes; 1 onion; 2 oz. dripping; 1½ quarts water; ½ teaspoonful salt; 1 pinch pepper; ½ teaspoonful sugar.

Wash, pare, slice, and parboil the potatoes; skin and scald the onion; chop it. Place the potatoes, onion, dripping, pepper, and salt in the cold water; cause the water to boil till the potatoes are quite soft (about half an hour). Crush the potatoes and onion with a fork or spoon till smooth. Add the sugar, and let the soup boil again. Instead of an onion, half a carrot (grated) may be used. If the soup is wanted richer, half a pint of milk may be added (after the potatoes are crushed), instead of the same amount of water.

Pea Soup. — *Required:* ½ lb. split peas; 2 oz. dripping; 1 piece soda (size of large pea); 3 pints water; ½ teaspoonful salt; 1 pinch pepper; ½ teaspoonful sugar.

Soak the peas over night in cold water, with the piece of soda to soften them; pour away the water with any of the peas floating on it; place the peas, with the dripping, in a pan with three pints of cold water; boil slowly till the peas are quite soft (about four hours); crush the peas with a spoon until smooth; add the salt, pepper, and sugar; boil again. Serve with small squares of dry toast. A teaspoonful of dry powered mint may be served with the soup; or it may be flavored with half a teaspoonful of curry powder broken with cold water, and added to the soup an hour before it is ready.

Haricot Bean Soup. — *Required:* ½ lb. haricot beans; 1 oz. dripping; 1 piece soda (size of pea); 1 pint milk; 2 pints water; ½ teaspoonful salt; 1 pinch pepper; ½ teaspoonful sugar.

Prepare in the same way as pea soup, except that the beans should be rubbed through a colander to keep back the skins (which are difficult to digest, though nourishing), and the milk added before boiling again. 1 oz. dripping may be used instead of milk.

Brown Vegetable Soup. — *Required:* a small carrot; 1 small turnip; 1 small onion; 1 oz. oatmeal; 1½ oz. dripping; 3 pints cold water; ½ teaspoonful salt; 1 pinch pepper.

Cleanse the carrot and turnip; skin and scald the onion. Chop them all very small, and dry them with a cloth. Brown the vegetables to a golden color with the dripping in a stewpan; put in the oatmeal, stirring till it also is a golden color. Draw the pan to one side to allow the contents to cool a little. Pour in the cold water gradually, stirring till the whole is quite smooth. Boil slowly for at least one hour. Add the pepper and salt a quarter of an hour before serving.

Any other vegetables may be used instead of the above. Flour may be used instead of oatmeal.

Ox-Tail Soup. — *Required:* 1 ox-tail; 1 oz. dripping; 1 bunch flavoring herbs, or ½ teaspoonful celery-seed tied in a small piece of muslin; 1 oz. flour; 2½ quarts hot water; ½ teaspoonful browning; ½ teaspoonful salt; ½ teaspoonful pepper.

Divide the tail into joints; remove the fat from it; brown the pieces with the dripping in a stewpan; pour off the dripping; add the water, flavoring, and browning. Heat it to boiling point, skim carefully, then simmer from four to five hours, till the meat is tender. Break the flour with cold water. An hour before the tail is ready, draw the pan aside, cool a little, and stir in the flour. Then finish the cooking, stirring occasionally, as the flour is apt to stick to the pan. Serve the soup with the pieces in it, or serve the soup and the pieces separately.

CURRY SOUP. — *Required:* ¼ lb. rice; 2 small onions or 1 large apple; ½ teaspoonful curry powder; ¼ teaspoonful sugar; 1 oz. dripping; 3 pints cold water; ¼ teaspoonful salt.

Skin, scald, and chop the onion; pare, quarter, core, and chop the apple; wash the rice. Melt the dripping in a stewpan; brown the onion and apple in it. Draw the pan to the side of the fire; break the curry powder with a little cold water; add it, the rice and water, to the pan, stir well. Place on the fire, and boil with the lid on till the rice and onion are thoroughly cooked, about three quarters of an hour, stirring occasionally.

The liquor fish has been boiled in may be used instead of water.

ECONOMICAL BROWN SOUP. — *Required:* about 2 lbs. roast-beef bones; 1 small carrot; 1 small turnip; 1 small onion; 1 dessertspoonful flour or corn-flour; 1 oz. dripping; 2 quarts cold water; 1 tablespoonful ketchup; ¼ teaspoonful browning; ½ teaspoonful salt; 1 pinch pepper.

Cleanse, prepare, and slice the vegetables; break the bones into several pieces. Brown the vegetables with the dripping in a saucepan; draw it to the side of the fire, add the bones, water, and seasoning; simmer gently for three or four hours, skimming carefully. Half an hour before it is ready, break the flour with a little cold water, and stir it carefully into the soup. When ready, remove the bones and vegetables, serve the soup. The bones may be used again in the stockpot; the vegetables may be used for vegetable soup, or for thickening any soup.

RICHER BROWN SOUP. — Prepare and cook as in last recipe: but, instead of roast-beef bones, use 1 lb. leg of beef; cut it into two or three pieces, and brown it with the vegetables.

POT-AU-FEU. — *Required:* 2 lbs. ribs of beef; 1 small cabbage; 1 ordinary sized carrot; 2 small white turnips; 1 leek or onion; 4 large potatoes; 1 bay-leaf; ¼ teaspoonful celery-seeds tied in a piece of muslin; 4 pints hot water; ½ oz. salt; 6 peppercorns.

Put the beef into a saucepan and cover with the hot water, add the salt and pepper. Cover the saucepan and put it on the side of the fire, that it may be heated *very* slowly. When boiling, skim with an iron spoon, cover, and simmer very slowly for 1½ hours. Prepare the vegetables; scald the cabbage, add it, the carrot, bay-leaf, and celery-seed; simmer for half an hour; then add the leek, turnips, and potatoes, and allow the whole to simmer for another hour. If the meat cooks fast, it will fall to pieces and have no taste. Remove the celery-seed and the peppercorns; arrange the meat on a large dish; place all the vegetables round the meat; pour a large cupful of the broth into the dish, and serve hot. Remove the fat from the broth, break some dry rusks in a soup-tureen, and pour the boiling broth over them. Keep the meat hot while the soup is served.

FRANCATELLI'S OX-TAIL SOUP. — Procure two fresh ox-tails; cut each joint, after dividing them, into inch lengths with a small meat-saw; steep them in water for 2 hours, and then place them in a stewpan, with 3 carrots, 3 turnips, 3 onions, and 2 heads of celery, 4 cloves, and a blade of mace. Fill up the stewpan with broth from the boiling stock-pot; boil this by the side of the stove-fire till done; drain the pieces of ox-tail on a large sieve, allow them to cool, trim them neatly and place them in a soup-pot. Clarify the broth the ox-tails were boiled in, strain it through a napkin into a basin, and then pour it into the soup-pot containing the trimmed pieces of ox-tails, and also some small olive-shaped pieces of carrot and turnips that have been boiled in a little of the broth, and a small lump of sugar; add a pinch of mignonette pepper, and, previously to sending the soup to table, let it boil gently by the side of the stove-fire for a few minutes.

This soup may be served also in various other ways, by adding thereto a *purée* of any sort of vegetables; such, for instance, as a *purée* of peas, carrots, turnips, celery, or lentils.

STOCK. — *Required:* 1 lb. leg of beef (lean); 1 small carrot; 1 small turnip; 1 very small onion; 1 sprig parsley; 1 small bay-leaf; 1 clove; 3 or 4 peppercorns; 3 pints cold water; ¼ teaspoonful salt.

Prepare the vegetables; cut them into thick slices; cut the meat into small pieces; put the vegetables and meat into a saucepan with the parsely, bay-leaf, prepared onion, salt, and cold water. Cover the saucepan and allow the water to come slowly to the boil; skim well; add the pepper and the clove, and simmer very gently for four hours. Lay a clean cloth in a colander; strain the stock through it into a basin. Let it get cold, and remove all the fat.

CLEAR SOUP. — *Required:* 1 pint of stock; the white and shell of 1 egg.

Remove all fat very carefully from the stock; put the stock into an enamelled pan with the white of egg and the shell; whisk all together till the stock looks frothy on the surface, then stir over a slow fire till it steams. Leave off stirring, and allow the soup to boil thoroughly for about five minutes; draw the pan to the side of the fire, and let it stand for about fifteen minutes, to allow the scum to rise and curdle. Lay a clean cloth in a colander; strain the soup through it into a basin. Cut neatly small pieces of vegetables; boil them till tender; add to the strained soup; add also a very small piece of loaf sugar, as it makes the soup sparkle. Heat the soup, and serve.

FISH

To Fry Fish. — Clean and dry the fish well; cut it up into neat pieces, and prepare them for frying in one of the following ways: —

1st. Break flour with enough of cold water to make it a thick batter; dip each piece of fish into this, and fry.

2d. Brush the pieces over with milk; toss them in flour in a sheet of kitchen paper; shake off the loose flour; fry.

3d. Dip the pieces into batter No. 1 (as above); toss them in stale-bread crumbs in a sheet of kitchen paper; shake off the loose crumbs; fry.

4th. Break an egg on a plate; beat it up slightly; dip the pieces in this; toss them in stale bread crumbs in a sheet of kitchen paper; shake off the loose crumbs; fry.

Instead of bread crumbs prepared from the crumbs of bread alone, crusts or any stale bread may be used, which are dried in the oven (not allowed to brown), pounded and kept in tightly corked bottles for use.

Filleted Fried Fish. — A thick fish, such as haddock, should be filleted before frying. This is done by cutting the flesh off at the back, beginning at the head, using a sharp knife. The bones should be used for soup or sauce.

Fried Herrings. — *Required:* 2 herrings; 1 oz. oatmeal; 1 oz. dripping.

Cleanse and dry the herrings; cut off their fins; toss the herrings with the oatmeal in a sheet of kitchen paper till as much as possible has stuck to them. Heat the dripping in a frying-pan; fry the herrings for about five minutes.

Boiled Fish. — Boil according to general directions. Serve with melted butter, parsley sauce, or egg sauce.

Boiled Salt Fish. — Soak the fish all night in cold water; cut it in neat pieces; place them in a pan with plenty of cold water. Cause the water to boil, and simmer for twenty minutes or half an hour. Serve with egg sauce.

Fish Cakes. — These may be made of any pieces of fish, cooked or uncooked.

1st Way. — *Required:* ½ lb. cold fish; ½ lb. cold mashed potatoes; ½ oz. dripping; about 1 tablespoonful of milk; ¼ teaspoonful salt; ¼ teaspoonful pepper.

Remove the skin and the bones carefully from the fish; break it into small pieces; mix thoroughly with the potatoes, melted dripping, salt, pepper, and milk. Shape into neat small cakes upon a floured board, with a knife dipped in flour. Brush over with a little milk, and toss in flour in a sheet of kitchen paper; shake off the loose flour; fry.

2d Way. — Prepare as in first way, using bread crumbs, and ½ teaspoonful of finely chopped parsley instead of potatoes.

3d Way. — Prepare as in first way, using cold boiled rice instead of potatoes.

In the above three ways, instead of brushing with milk and using flour, egg and bread crumbs may be used.

Fish Pudding.— Prepare the mixture according to first, second, or third way of making fish cakes. Instead of shaping into cakes and preparing for frying, place the mixture in a well-greased pie-dish. Place small pieces of dripping over the top, and brown in an oven or before the fire.

Savory Fish Pie. — *Required:* ½ lb cold boiled salt fish; ½ lb. cold mashed potatoes; 2 onions, previously boiled; 1½ oz. dripping; ¼ teaspoonful pepper.

Break the fish into small pieces; mince the onion. Grease a small pie-dish well; place a layer of fish at the bottom, then a layer of potatoes with onions sprinkled over; then fish, potatoes, and onions again. Place small pieces of dripping over the top, and brown in an oven or before the fire.

Baked Fish. — *Required:* a flat fish; 1½ oz. dripping or butter; 1 dessertspoonful stale bread crumbs; 1 teaspoonful chopped parsley; 1 small onion boiled and chopped; ½ gill water; ½ teaspoonful vinegar; ¼ teaspoonful salt; ¼ teaspoonful pepper.

Melt half of the dripping in a tin baking-dish; cut the fins off the fish; clean it; place it in the dish and pour the water and vinegar over it. Mix the parsley, onion, salt, pepper, and bread crumbs;

sprinkle them over the fish; place the dripping in small pieces over the fish; bake in an oven from ten to twenty minutes, according to the thickness of the fish.

The dish is more delicate if lemon-juice is used instead of vinegar.

Haddock Stuffed and Baked. — *Required:* 1 haddock; 2½ oz. bread crumbs; 1 dessertspoonful chopped parsley; 1 dessertspoonful chopped onion (previously boiled); 2 oz. dripping; 1 tablespoonful milk; ½ teaspoonful salt; ¼ teaspoonful pepper.

Clean and wipe out the haddock; cut off the fins. Rub 1½ oz. bread crumbs and 1 oz. dripping well together; add the chopped parsley, onions, salt, and pepper; stir in the milk to bind it. Stuff the mixture into the haddock, sew it up neatly and place it on a greased baking-tin. Brush it over with melted dripping, sprinkle with the rest of the bread crumbs, and bake in an oven (basting occasionally) for about half an hour.

This dish may be improved by using butter instead of dripping, and an egg instead of milk.

Baked Herrings. — *Required:* 2 fresh herrings; say 1 gill water; say 1 gill vinegar; 6 peppercorns; 1 blade mace; ½ teaspoonful salt.

Cleanse and dry the herrings; cut off the heads, tails and fins. Cut from the opening already made for cleaning down to the tail end. Lay them on their backs; remove the bones; sprinkle the salt over them; roll them up, beginning at the tail end. Place them in a small pie-dish with the peppercorns and mace; pour over them enough vinegar and water to cover them; bake in the oven for three quarters of an hour.

Stewed Herrings. — Prepare in the same way as in the last recipe, but, instead of baking in a pie-dish, stew slowly in a pan for half an hour.

Any other white fish may be stewed in the same way.

Broiled Mackerel. — *Required:* 1 mackerel; ½ oz. dripping or butter; 4 sprigs of parsley; 1 pinch of salt; 1 pinch of pepper.

Open the fish by cutting it down the back. Wash it well in cold water and dry it with a cloth. Rub a hot gridiron with a greased paper, and lay the fish on it over a clear fire; when brown on one side, turn over on the other. Wash the parsley in cold water; pick it off the stalks; dry it with a cloth; chop finely; mix with the butter on a plate, using a knife; add to it the salt and pepper. Put the fish on a hot plate, and spread butter on it.

Any other fish may be cooked in the same way, with or without the parsley and butter.

Finnan Haddocks. — *Required:* 1 small finnan haddock; ½ oz. butter; ½ pint milk; ¼ teaspoonful flour.

Wipe the haddock with a damp cloth; cut it into four pieces; roll the pieces in the flour; place them in a stewpan with the milk and the butter. Cause it to boil very slowly and simmer slowly for about five minutes. Serve on a very hot plate with the sauce round it.

Potted Yarmouth Bloaters. — *Required:* 6 fresh-cured bloaters; immerse them in scalding water, and remove the skins; wipe them dry, take out the bones, and put the fillets of the herrings into a stewpan, with ½ a pound of clarified fresh butter, a blade of mace, and enough cayenne to season them; set this on a slow fire to simmer for about ten minutes, then thoroughly pound the whole well together in a mortar, and rub it through a sieve. Put this preparation into pots, run a little clarified butter over the suface, and keep them in a cool place for use.

Smoked or kippered salmon, or finnan haddocks, may be potted in the same way as the foregoing. By submitting any of the above-described potted shell-fish, etc., to the action of steam, a sufficient time for the meat to be thoroughly penetrated by the heat, they may keep good for months. Much will, however, depend on the freshness of the butter used in this preparation; should it become rancid, as frequently happens after keeping for a few weeks, it will, of course, considerably impair the flavor of the potted fish.

Boiled Mackerel. — Boil the mackerel in salt and water, dish it up, and send to table, either with fennel, parsley, or gooseberry sauce.

Broiled Mackerel à la Maître d'Hôtel. — Split the mackerel down the back, season with pepper and salt, and oil it over; then place it on a gridiron, over a moderate fire; when the mackerel is done on one side, turn it over on the other; and, as soon as it is done through, take it up on a dish and put some cold *Maître d'Hôtel* butter inside, and send to table.

Broiled Mackerel with Nut-Brown Butter. — Broil the mackerel as directed in the last article; then dish it up; garnish it round with fried parsley, and pour over it some nut-brown butter.

Fillets of Mackerel à la Maître d'Hôtel. — Fillet the mackerel thus: Place the fish on the table with its back toward you, then run the knife in just below the gills, turn the edge of the blade under, press with the fingers of the left hand full on the upper end of the fillet, and, bearing with the blade of the knife upon the side of the backbone, draw the knife gently down to the tail, and turn the mackerel over and take the fillet off the other side; when this is done, cut each fillet into two; trim the ends neatly, and place them side by side on a buttered sauce-pan; season with pepper and salt and chopped parsley; squeeze the juice of half a lemon over them, and then pour a little oiled butter upon each, and cover with a round of buttered paper. About twenty minutes before dinner either put them in the oven or on a stove-fire to simmer, and, when done, drain the fillets on a napkin; dish them up in the form of a wreath, the fillets resting upon each other; sauce them over with some *Maître d'Hôtel* sauce, and send to table.

The soft roes, if any, in the mackerel, should be parboiled in boiling water containing a little vinegar and salt; then drain them on a napkin, and place them in the centre of the fillets when dished up.

OYSTERS.

Escaloped Oysters.—Open a sufficient quantity of oysters for the purpose, and put them in a stewpan on the fire to blanch or parboil; after boiling for a few minutes, drain them on a sieve, reserving their liquor to make the sauce with; immerse the oysters in cold water so as to wash off any scum or surf that may adhere to them; take away the beard and gristly substance, and place the oysters thus prepared on a plate, while the sauce is being made in manner following: Into a small stewpan put two ounces of fresh butter, one tablespoonful of flour, a very little pepper, and salt; with a wooden spoon mix the whole thoroughly, moisten with the oyster liquor and half a pint of cream, add a small piece of glaze, and then stir the sauce on the fire till it boils; keep stirring this for about ten minutes, by which time it will be sufficiently reduced to admit of the oysters being added to it; then squeeze in the juice of half a lemon, mix the whole well together, and, after putting the oysters in the silver scollop-shells (or clean scoured oyster-shells will do), cover them with fried bread crumbs. About ten minutes before serving, place them in the oven till they are sufficiently hot to send to table, dish them on a napkin, and serve.

Escaloped muscles, cockles, shrimps, lobsters, or crayfish may be prepared in like manner; a little essence of anchovies should, however, be added to the sauce for all these,—except muscles and cockles; and for lobsters, the coral should be added also.

Stewed Oysters.—Put one quart of oysters and one half-pint of water into a tin pail, and set it into a kettle of boiling water; let it boil till the oysters are cooked, then strain, putting the oysters into a soup tureen and the liquor back into the pail, and add one pint of milk; set in water as before and heat boiling hot, seasoning with salt and pepper. Add to the oysters a piece of butter the size of an egg; lastly pour the hot liquor on them.

STEWING.

The flavor of stews may be inexpensively varied by the use of various herbs. Although the gravy of stews may be made with water, they will be richer and more nourishing if, instead of water, they are made with the liquor in which meat has been boiled, liquor from the stockpot, stock made with a few cooked or uncooked bones, or gravy left over from previous stews. When it is not convenient to add the water or liquor warm, it may be added cold

Irish Stew—*Required:* ½ lb. flap (or brisket) of mutton, or any fat scraps; 1 lb. of potatoes; 2 onions; about 1 pint warm water; ½ teaspoonful salt; ½ teaspoonful pepper.

Clean, pare, and parboil the potatoes; cut them into slices; skin and scald the onions, cut them into slices. Cut the meat into small pieces; put a layer of potatoes in the bottom of the pan, then some meat, onion, pepper, and salt; then more potatoes, meat, onion, etc., till all the meat, onions, and salt, and half of the potatoes, are in. Add the water; simmer slowly for half an hour; add the rest of the potatoes and simmer for another half-hour. If the meat is tough, it may be cooked a little longer. Irish stew may be made of cold fat meat, or Australian meat, by cooking the potatoes and onions first, then letting the mixture cool, and only adding the meat to warm it thoroughly. To vary this recipe, the meat may be browned with a little dripping before stewing it.

Haricot Mutton.—*Required:* ½ lb. lean mutton; ½ turnip; ½ carrot; 1 onion; ½ oz. dripping; ½ pint warm water; ½ teaspoonful browning; ½ teaspoonful salt; 1 pinch pepper.

Cleanse and prepare the carrot and turnip; cut them into neat pieces, place in boiling water for five minutes. Scald and skin the onion, cut into slices; cut the mutton into neat pieces, brown them with dripping in a stewpan; brown the onion slightly. Pour away dripping; add water, simmer with the lid on half an hour; add vegetables and simmer for another half-hour. Five minutes before serving, add coloring. Serve with meat and onions in the middle of the dish, carrots and turnips at the sides

A nice dinner can be made of a cheap piece of beef. Put 2 lbs. into a kettle with 3 pints of water, stew gently 3 hours, then pour off the liquor and brown the meat in the kettle, putting in a piece of butter the size of an egg. When browned, pour the liquor back, and, when it boils, stir in 1 tablespoonful of flour or cornstarch dissolved in ½ a cup of water. Pepper and salt to taste.

STEWED BEEF. — *Required:* ½ lb. stewing beef; ½ carrot; ½ turnip; 1 onion; 1 oz. dripping; 1 pint warm water; ½ oz. flour; 1 dessertspoonful of ketchup; ½ teaspoonful salt; 1 pinch pepper.

Cleanse, prepare, and slice the carrot and turnip; skin, scald, and slice the onion. Brown the piece of beef in a stewpan, then brown slightly the vegetables. Pour away the dripping; add the water and ketchup to the beef and vegetables. Break the flour with a little water, stir it smoothly in. Simmer with the lid on for an hour (longer if the meat is tough, or if a large piece is used), but do not allow it to boil; stir frequently to prevent the flour sticking to the pan. When nearly ready, add the salt and pepper. Arrange neatly on a dish.

STEWED KIDNEYS. — *Required:* ½ an ox kidney or 2 sheep's kidneys; ½ oz. flour; ½ oz. dripping; about 1 quart cold water; ½ teaspoonful salt; ½ teaspoonful pepper.

Cut the kidney into small pieces, removing all the fat; place them in a small stewpan with the water; stew slowly for about three hours, till tender. Melt the dripping in a very small pan, stir in the flour; add some of the liquor gradually, stir till quite smooth; add this with the pepper and salt to the stewed kidneys a quarter of an hour before they are ready. Arrange neatly on a dish with a wall of mashed potatoes or boiled rice round.

STEWED TRIPE. — *Required:* 1 lb. tripe; 3 onions; 1 oz. flour; ½ pint milk; 1 pinch of salt; 1 pinch of pepper.

Lay the tripe to soak all night in cold water; next day wash it in warm water with a piece of soda in it the size of a pea, but do not let it soak in this, as the soda will harden the tripe. Place the tripe in plenty of cold water, cause it to boil; if the water has not a pleasant smell, pour it away and place the tripe again in cold water; make it boil again; repeat this till the tripe and water are quite sweet. Then simmer gently for five or six hours till the tripe is thoroughly tender. Skin and scald the onions; add them one hour before the tripe is ready. Break the flour with the milk; add half a pint of the liquor the tripe has been boiled in; boil five minutes. Chop the onions; cut the tripe into neat pieces, add it to the sauce with the pepper and salt, and serve. The liquor tripe is boiled in is nutritious, and may be used instead of water for some of the cheap soups.

WILD FOWL is very nice stewed and seasoned with butter, pepper, salt, and a little cream or milk. A little flour stirred in to give the gravy the consistency of cream improves it. Have ready some nice warm-soda biscuit, split them open and place on a deep platter, pour your stew over this, and you have a very palatable dish.

COLD MEAT DISHES.

SCOTCH HASH. — *Required:* ½ lb. cold meat; 1 sprig of a flavoring herb; 1 heaped teaspoonful flour; ½ oz. dripping; ½ pint pot liquor or water; 1 large tablespoonful ketchup; ½ teaspoonful vinegar; 1 pinch of pepper; ½ teaspoonful salt.

Cut the meat into thin slices; melt the dripping in a small stewpan; remove it from the fire; add the flour and mix well; pour in gradually the pot liquor or cold water, stirring till smooth. Add the other ingredients except the meat; stir over the fire till it has boiled for three minutes. Draw the pan to the side of the fire to allow the sauce to cool; remove the sprig of herb; place the pieces of meat in the sauce; simmer very gently for about ten minutes; be careful not to let it boil, as the meat will harden. Serve hot, with sippets of toasted bread.

FRUGAL PIE. — *Required:* ½ lb. cold meat; 1 lb. cold potatoes; 2 small onions; 1 sprig flavoring herb; 1 teaspoonful flour; 1 oz. dripping; 1 tablespoonful milk; 1 teacupful cold water or pot liquor; ½ teaspoonful pepper; ½ teaspoonful salt.

Cut the meat into thin slanting slices, with the grain, not against it. Skin, scald, and slice the onions, and brown them slightly with half of the dripping in a pan; pour away the dripping; break the flour with a little cold water; add it with the rest of the water, the sprig of herb, salt, and pepper to the onions. Simmer till the onion is tender, about one quarter of an hour, stirring to prevent the flour sticking to the pan. Remove the sprig; let the sauce cool; pour it into a pie-dish; place the pieces of meat in it. Mash the potatoes; add the milk and the other half of the dripping to them. Lay the potatoes smoothly on the top of the meat; score them across with a knife. Put the pie into the oven to brown; when browned, it is ready. If there is no oven, place the pie on the hob or hot plate for a few minutes to warm through, but do not allow it to boil; then brown it in front of the fire. The top of the pie may be glazed by brushing it over with a little milk before cooking.

Macaroni and Meat Shape. — *Required:* ¼ lb. macaroni; ¼ lb. scraps of cooked meat; 1 oz. stale bread crumbs; ¼ teaspoonful powdered mixed herbs; about ½ gill water or milk; ½ oz. dripping; ¼ teaspoonful salt; 1 pinch pepper.

Place the macaroni in a pan of cold water; cause it to boil for a period of about twenty minutes, till soft but not pulpy. Drain the macaroni, and let it get cold. Chop the meat finely; mix it with the crumbs, herbs, salt, pepper, and water. Grease a small pudding bowl; line the bottom of it with some macaroni; put in some of the meat; then gradually line the basin, placing more meat in the middle to prevent the lining falling in. If any macaroni is over, place it on the top of the meat. Cover the basin tightly with a well-greased paper; steam for half an hour to three quarters; turn out on a dish; serve hot.

A quicker way: Cut the boiled macaroni in small pieces, and mix with the meat. Rice may be used instead of macaroni.

Bread and Meat Shape. — *Required:* ¼ lb. scraps of bread; ¼ lb. scraps of cooked meat; ¼ teaspoonful powdered mixed herbs; 1 onion (previously boiled); 1 oz. dripping; about 1 gill water or milk; ¼ teaspoonful salt; ¼ teaspoonful pepper.

Soak the bread for an hour in cold water; press all the water out and beat the bread smooth with a fork. Chop the meat and onion very fine; mix all the ingredients well together, except ½ oz. of dripping. Grease well a basin; place the mixture in it; cover tightly with a well-greased paper, leaving room for the bread to swell, and steam for three quarters of an hour. When the basin is lifted out of the water, let it stand for two minutes, then turn out; serve hot or cold.

Any cooked vegetables may be finely chopped and used instead of, or in addition to, the meat and onions.

A very nice way to serve scraps of cold meat is to cut them in small bits, add a little water, pepper, salt, butter, onion, or sage, and stew it awhile. Do not get it too juicy.

Another way is to chop it fine and season as above. Leave it quite juicy and pour over toast.

Still another: Chop the meat fine, add pepper, salt, one egg, a cracker rolled fine, and a few ground cloves if preferred. Press into a loaf, and brown slightly in the oven. This makes nice sandwiches, or is nice sliced for tea.

Yet another: Hash any kind of cold meats fine, season with pepper, salt, sage, and onion (or either), add mashed potato and an egg. Have cracker rolled fine; and roll the meat, made in flat cakes, in the cracker; and fry in butter, or butter and lard.

MEAT PIES AND PUDDINGS.

Chicken Pie à la Reine. — Cut two chickens into small members, as for fricassee; cover the bottom of the pie-dish with layers of scollops of veal and ham placed alternately; season with chopped mushrooms and parsley, pepper and salt, then add a little white sauce; next place in the dish the pieces of chicken in neat order, and round these put a plover's egg in each cavity; repeat the seasoning and the sauce, lay a few thin slices of dressed ham neatly trimmed on the top; cover the pie with puff-paste, ornament this with pieces of the same cut into the form of leaves, etc.; egg the pie over with a paste-brush, and bake it for one hour and a half. A very good chicken pie may be made by omitting the plover's eggs, mushrooms, ham, and the sauce, substituting for these the yolks of eggs boiled hard, chopped parsley, bacon, and a little mushroom-catsup, some common gravy, or water.

Pigeon Pie à l'Anglaise. — Draw, truss, and singe six young pigeons; then stuff them with the chopped livers, mixed with some parsley, a small piece of butter, pepper, and salt. Next, cover the bottom of the dish with rather large scollops of beef, taken either from the fillet or rump; season with chopped parsley and mushrooms, pepper, and salt; over these place the pigeons, and between each pigeon put the yolk of an egg boiled hard, placing two or three in the centre also; add some white or brown sauce, whichever may be at hand, in sufficient quantity to produce sauce enough for the dish, or, if neither of these be ready, then substitute some gravy or common broth; repeat the seasoning, cover the pie with puff-paste, bake it for an hour and a half, and send to table.

Beefsteak-and-Oyster Pie — Cut three pounds of fillet of beef or rump steaks into large scollops, fry them quickly over a very brisk fire, so as to brown them before they are half done; then place them on the bottom of the dish, leaving the centre open, in two successive layers; fill the centre with four dozen oysters, previously parboiled and bearded, season with pepper and salt, and pour the following preparation over the whole: when the scollops of beef have been fried in a sauta or frying-pan, pour nearly all the grease out, and shake a tablespoonful of flour into it; stir this over the fire for one minute, and then add a pint of good gravy or broth, two tablespoonfuls of mushroom-catsup, and an equal quantity of Harvey sauce and the liquor from the oysters; stir the whole over the fire, and keep it boiling for a quarter of an hour. Half an hour after this sauce has been poured into the pie, cover it with puff-paste in the usual way, bake it for an hour and a half, and serve.

Veal-and-Ham Pie. — Trim the veal and ham into scollops, and season with pepper and salt in moderation. Next chop a handful of mushrooms and some parsley very fine, and put them in a small stewpan with a small pat of butter, and one shallot also chopped fine; fry these lightly over the fire, then add nearly a pint of good stock; boil the whole for five minutes, and pour it into the pie; place six yolks of eggs boiled hard in the cavities, cover with puff-paste, bake the pie for an hour and a half, and serve.

Mutton Pie à l'Anglaise. — Procure a neck of mutton, remove the scrag and the spine-bone, shorten the ribs to about three inches, and use these trimmings to make some stock or gravy for the pie. Next cut the mutton into neat chops, pare off the superfluous fat, season them with pepper and salt, and place them in the dish in circular order, one resting upon another, in the same way cutlets are dished up; fill the centre with small new potatoes, or old ones turned into round balls; boil the mutton stock down to the quantity required to nearly fill up the dish, season with pepper and salt, cover with puff-paste, bake the pie an hour and a half, and send to table.

Beefsteak-and-Oyster Pudding. — Line a 2-quart pudding basin with some beef-suet paste; fill this lining with a preparation similar to that described for making beefsteak-and-oyster pie, except that the sauce must be more reduced. When the pudding is filled, wet the edges of the paste round the top of the basin with a paste-brush dipped in water, cover it with a piece of suet-paste rolled out to the size of the basin, fasten it down by bearing all round the edge with the thumb; and then, with the thumb and forefinger, twist the edges of the paste over and over, so as to give it a corded appearance. This pudding must be either steamed or boiled three hours; when done, turn it out of the basin carefully, pour some rich brown gravy under it, and serve

Mutton Pudding. — Line a basin as in the above case, fill the lining with thick mutton cutlets, slightly trimmed, or, if preferred, with steaks cut from the leg; season with pepper and salt, some parsley, a little thyme, and one small shallot chopped fine, and between each layer of meat put some slices of potatoes. Cover the pudding as in the foregoing article, steam or boil it for three hours, and serve some rich gravy under it when sent to table.

Kidney Pudding. — Cut two pounds of sheep's or lamb's kidneys into scollops, put them into a basin with some chopped parsley, shallot, and a little thyme, and season with pepper and salt; then add a large gravyspoonful of good sauce, and the juice of half a lemon; mix these ingredients well together. Line a basin with suet-paste, and fill the pudding with the foregoing preparation; cover it in the usual way, steam or boil it for two hours and a half, and, when sent to table, pour under it some rich brown gravy to which has been added a little Indian soy, and serve.

Sausage Pudding. — Procure two pounds of sausages, and twist each into three round balls; put these into boiling water, on the stove, merely to parboil them for a minute or so, then throw them into cold water and afterward remove the skins. Line the pudding basin with suet-paste, fill it with the sausages, and pour the following preparation upon them: Chop one onion and three sage-leaves, boil these in water for two minutes, drain them upon a sieve, and then fry them in a small stewpan with a piece of butter; as soon as they become of a light-brown color, add a tablespoonful of flour and a teaspoonful of curry-paste, season with pepper and salt, and moisten with half a pint of good broth; stir the sauce upon the fire, and, when it has boiled a quarter of an hour, rub it through a sieve, and use it as above directed. Cover the pudding with paste, steam or bake it for two hours, and, when turned out of the basin, send to table with plain gravy under it.

To Boil an Egg. — Place an egg gently with a spoon in water almost, but not quite, boiling. Let it simmer steadily for three and a half minutes. A small egg is sufficiently cooked in three minutes; a new-laid egg takes four minutes.

To Hard-Boil an Egg. — Place the egg gently with a spoon in water almost, but not quite, boiling; let it simmer for ten minutes; dip it into cold water, to prevent the white discoloring; when required, remove the shell.

Poached Eggs. — *Required:* 1 egg; boiling water; 1 tablespoonful of vinegar to 1 pint of hot water; 1 round of toast.

Add the vinegar to the water; break the egg into a cup; slip it gently from the cup into the pan of simmering water. Simmer for about three minutes; lift out of the pan with a pierced fish-slice; place the egg on a half round of toast; serve hot

Baked Eggs. — *Required:* 1 egg; ½ oz butter

Place the butter in a very small baking-tin; melt it; break the egg into a cup; slip it from the cup into the tin; place the tin in the oven for three minutes, when the egg will be cooked.

Rummelled Eggs. — *Required:* 1 egg; 1 slice of buttered toast; 1 desertspoonful milk; ½ oz. butter; 1 pinch of salt.

Melt the butter in a small frying-pan; break the egg into it; add the milk and salt; stir constantly one way till the egg becomes thick like butter, but not hard; spread it over the buttered toast; serve very hot.

Omelet. — *Required:* 2 eggs; ½ oz. butter; 1 teaspoonful soft sugar; 1 small pinch of salt.

Break the eggs; separate the yolks from the whites; add the sugar to the yolks; stir in a basin till they are thick and creamy (about ten minutes). Place the whites with the salt on a dry plate; with a dry sharp knife whisk them in a cool place till they become a stiff froth; mix this gradually in among the yolks, taking care not to beat down the froth. In the mean time let the butter melt, but not discolor, in an omelet-pan; pour the mixture into the pan; cook it on the fire till it sets (about two minutes); then place it in the oven, to allow it to rise and brown. If there is no oven, hold it before the fire. Turn it out, double it over, and serve immediately.

The omelet will be larger and lighter if a third white can be allowed to the two yolks. A *savory omelet* may be made by adding half a teaspoonful of mixed herbs or chopped parsley to the yolks instead of sugar. An omelet-pan should not be washed; it should be scraped and dry-rubbed.

Egg Pancakes. — *Required:* 2 oz. flour; 1 egg; 2 oz. clarified fat; 1 gill milk; 2 oz. sugar; 1 small pinch of salt.

Put the flour and salt in a basin; add the egg and stir well with a wooden spoon; then pour in the milk gradually, stirring all the time, being careful to have no lumps in the batter. Put two and a half tablespoonfuls of the batter in a cup; melt a fourth of the fat in a small frying-pan. When hot pour in the batter from the cup, holding the pan so that the batter should cover the whole of it. Let the pancake set, then with a knife see that it does not stick anywhere. Shake it a little, and either toss it over or turn with a long, thin knife. When a golden brown on both sides, put it on a plate, dredge with sugar, fold the pancake in three, or roll it up and dredge again with sugar. Serve very hot. The above quantities will make about four pancakes. When time permits, prepare the batter some hours before, as it is improved by standing.

If preferred, pancakes may be made a little lighter by adding only the yolk at first to the flour, etc.; then add the milk as directed. Whisk the whites to a stiff froth, just before the pancakes are to be cooked, and add lightly. A few drops of lemon-juice squeezed over each pancake is a great improvement.

Snow Eggs. — *Required:* 1 egg; 1½ gills milk; ½ inch stick-cinnamon; 1 heaped teaspoonful sugar.

Break the egg; separate the yolk from the white; put the milk, cinnamon, and sugar into a small pan (enamelled preferred); heat this to the boiling point and beat the white with a knife on a dry plate to a very stiff froth; dip a tablespoon in cold water, scoop out the froth in spoonfuls and drop into the boiling milk; boil slowly for three minutes, turn the froth over, and cook the other side for three minutes; put this snow on a cloth to drain; stir the yolk in a cup with a spoon until it is creamy; add gradually the milk slightly cooled; remove the cinnamon; put the milk and egg back into the saucepan, and stir always one way over a slow fire till it thickens, but it must not boil; pour this custard into a shallow dish, and, when cold, place the snow upon it.

Poached Eggs with Minced Beef. — Pare the fat and skin off one pound of roast beef, cut it into thin, small slices, and then mince these very fine by chopping them; put the mince into a stewpan with two large gravyspoonfuls of brown sauce, and a small piece of glaze, stir the whole over the fire until quite hot, dish it up in a conical form, place six poached eggs round the mince, pour a little brown sauce round the base, and serve.

Lobster Salad. — Boil two fresh eggs hard, take the yolks, and mix them in a tablespoonful of good cream; add two tablespoonfuls of salad oil. Now mix separately a teaspoonful each of fine salt, and made mustard, and a gill of malt vinegar. Add this mixture gradually to the eggs, cream, and oil, and let them be thoroughly incorporated. Then break up a large lobster, mix the soft parts with the dressing and put it at the bottom of the dish; then cut up the meat of the claws and tail into small pieces, mix with chopped endive and lettuce, put it on the dressing, and serve.

Another way: Cut up some lettuces and endive, and put them into your salad-bowl, with any small salad in season, and make a dressing thus: Mix together, perfectly smooth and creamy, one tablespoonful of made mustard, two tablespoonfuls of vinegar, and four tablespoonfuls of salad oil, the yolks of two hard-boiled eggs, a few drops of essence of anchovy, cayenne, and salt to taste. Mix this dressing with the soft parts and the pickings of the lobster, and pour over the lettuce, etc. Then take the solid meat of the fish, and cut it into moderate pieces, and put it into the salad. Garnish with sliced eggs (hard-boiled) and a few slices of cucumber.

Plain Salad. — *Required:* One lettuce; mustard (the vegetable); cress; salad sauce.

The vegetables must be very fresh. Cleanse the vegetables; break off each leaf of the lettuce carefully; cut or break them across in small pieces; wash these pieces again in cold water; drain them and toss them in a dry towel to dry. Arrange the lettuce, mustard, and cress according to taste. Just before serving, add the salad sauce, and sprinkle the chopped hard-boiled white of egg over the salad.

A good addition to salad is radishes (washed and brushed), either whole or in slices.

Salad Dressing for Lobster. — Three well-beaten eggs, one half teaspoonful of salt, one half teaspoonful of pepper, one half tablespoonful of mustard, one half coffee-cup of vinegar, a piece of butter half the size of an egg; stir well, cook in a dish of boiling water, let it cool thoroughly, then add one half cup of cream.

Beet Salad. — One quart boiled beets; 1 raw cabbage, chopped fine; 1 teaspoonful of black pepper; 2 cups of brown sugar; 1 tablespoonful of salt. Mix thoroughly, and cover with vinegar in a close jar.

Salad Dressing. — Four tablespoonfuls of sugar, 2 of salt, 3 of mustard; stir these thoroughly together dry. Beat the yolks of 3 eggs and add the dry mixture *slowly*, beating all the time ½ large size bottle of oil, or a coffee-saucer of melted butter; 2 teacups of best cider vinegar. Add about 1 tablespoonful of butter and beat that in, then the same of vinegar and beat that, and so on till it is all mixed. The last thing, add the whites well beaten. This makes 1 quart. Four small lobsters; 2 small heads of lettuce; 1 teaspoonful of black pepper; add dressing.

Salad Mixture. — Boil an egg fifteen minutes, take away the white, and bruise in a basin the yolk and make it quite smooth, and add 1 teaspoonful of moist sugar, 1 of salt, ¼ of a teaspoonful of pepper, 2 teaspoonfuls of made mustard; mix all these ingredients well together, then add 2 spoonfuls of best salad oil, and stir thoroughly, then 2 spoonfuls of cream, then stir well again; 3 spoonfuls of vinegar, and, if well stirred, no trace of oil is ever seen. A good salad mixture is one in which the taste of no single ingredient will predominate.

Potato Salad. — Boil 1 egg very hard, rub the yolk to a pulp; add 1 raw yolk, 1 teaspoonful of cornstarch or fine flour, 1 of vinegar, 1 of sweet oil, ½ teaspoonful of mixed mustard, 1 of salt, ½ cayenne pepper, 2 of sweet butter; beat thoroughly together to a smooth paste; slice cold potatoes thin, arrange in pyramid or mound shape, and pour the mixture over; ornament with slices of boiled eggs, parsley, radishes, and lemons, as you fancy; put on ice to cool.

Cabbage Salad. — One cabbage, 3 lbs.; 2 eggs, 1½ pints of vinegar, 3 tablespoonfuls of sugar, 1 teaspoonful of mustard, ¼ teaspoon of red pepper; piece of butter the size of an egg.

Chicken Salad. — Boil, bone, and chop fine 3 chickens; use chopped celery; take equal quantities meat and salad, and mix with the following dressings: Yolks of 3 eggs; stir them with a fork, then stir in slowly a cup of melted butter; do not put in faster than will mix nicely. Salt to taste, add a teaspoonful of powdered sugar, a cup of vinegar, and a pinch of red pepper.

Garnish of Truffles in Glaze. — Cut about one pound of truffles in various fancy shapes, such as small round balls, olives, or like quarters of orange, small pillars, and circular scollops; place them in a small stewpan, with a little fresh butter, a pinch of salt, and a piece of glaze; put on the lid of the stewpan, and set it on a slow fire to simmer for five or ten minutes; toss the truffles thus prepared in their glaze, and use them to garnish the centre of an *entrée*, or for any other appropriate purpose.

This is the foundation of all garnishes of truffles and mushrooms; an infinite variety may be made by adding to the truffles, prepared as above, some special sauce, the addition of which will then give its name to the garnish.

Aromatic Spices for Seasoning.—Take of nutmegs and mace one ounce each; of cloves and white peppercorns two ounces each; of sweet-basil, marjoram and thyme one ounce each; and half an ounce of bay-leaves. These herbs should be previously dried for the purpose. Roughly pound the spices, then place the whole of the above ingredients between two sheets of strong white paper, and, after the sides have been twisted or folded over tightly, so as to prevent as much as possible the evaporation of the volatile properties of the herbs and spices, place them on a baking-sheet in the screen to become perfectly dry; they must then be pounded quickly, sifted through a fine hair-sieve, corked up tightly in a dry bottle, and kept for use.

Frying Batter for all Sorts of Fruit Fritters.—Put into a basin ¾ of a lb. of sifted flour; 3 oz. of fresh butter (melted); 1 wineglassful of Curaçoa; and a very little salt. Mix these gently together with a wooden spoon, gradually pouring into the basin about half a pint of bitter ale. When the batter becomes mixed to the thickness of double cream, whisk the whites of three eggs into a substantial froth, and immediately mix.

Many prefer such fritters as pineapple, peach, apricot, or plum, fried with a plainer kind of batter; in making which, water is substituted for ale.

Fritters.—1 quart of buttermilk; 1 cup of cream, or 1 tablespoonful of butter; 4 eggs; ½ teaspoonful of saleratus; 1 teaspoonful of salt; and flour sufficient for a stiff batter.

PURÉES.

Purée of Mushrooms.—Clean a bottle of white button mushrooms; chop them up, adding meanwhile the juice of half a lemon to prevent them from turning black; when chopped fine, place them is a deep sauta-pan with a pat of butter, and with a wooden spoon stir them on the fire for five minutes; moisten with a ladleful of good white sauce; reduce the *purée* quickly, and then add half a pint of double cream; stir the *purée* on the fire for five minutes longer; rub it through a tammy on to a dish, and from thence remove it into a small stewpan for use.

Purée of Spinach.—Pick, wash, and boil a small dish of spinach; refresh it in cold water squeeze it thoroughly free from water; examine it carefully by separating it with the point of a knife, on the chopping board, so as to remove any straws, etc., left in it; next pound it well in the mortar, and then take it up in a deep sauta-pan, add a small ladleful of good, white sauce, a little grated nutmeg, salt, and a pinch of sugar; reduce the *purée* over a brisk fire, to preserve its color; rub it through a tammy or sieve, and remove it into a small stewpan. Just before using it, make it warm, and add two pats of fresh butter and a small piece of glaze.

Purée of Asparagus.—Break off the tender portions of a bundle of sprue asparagus; wash them in a large pan, with a good handful of green onions and double that quantity of pickled parsley; set these on the fire to boil in an untinned pan half full of boiling water, and throw in a handful of salt; as soon as the asparagus is done, drain it in a sieve, and remove all the water. Put the asparagus, parsley, and green onions all together into a deep pan, with a small ladleful of white sauce, the crumb of a French roll (that has previously been soaked in water, and afterwards pressed in a napkin to remove the moisture), some grated nutmeg, a little salt, and a teaspoonful of sugar; reduce the *purée* quickly on the fire; rub it through a sieve on to a dish, and from thence remove it into small stewpan, and keep it in the cool until wanted for use. Finish by adding a pat of fresh butter, a piece of glaze, and some spinach green, if required, to give it a bright-green color.

SAUCES.

Melted Butter.—Put 1 oz. butter in a stewpan; when it is melted put in ½ oz. flour; stir it quite smooth over the fire, and pour in by degrees ½ pint water. Stir till it thickens, then move it to the side of the fire.

This recipe will never fail to produce good melted butter free from lumps. If you cannot afford so much butter, use less; but never put more flour than butter. Melted butter too often resembles paste.

Parsley and Butter is made by stirring a teaspoonful of chopped parsley into the above just before serving.

Egg Sauce is melted butter made with milk instead of water, and an egg boiled ten minutes and allowed to get cool chopped up and put into it.

Bread Sauce is made by soaking 1¼ ounces of bread crumbs in ½ pint of milk a quarter of an hour, putting it on to boil 15 minutes, with an onion; six peppercorns and a pinch of salt in. Before serving, pick out the onion and the peppercorns.

Mint Sauce. — Wash clean and chop fine a handful of mint without the stalks; dissolve ½ oz. sugar in ½ gill water; add to it 1 gill vinegar and the chopped mint; mix well together.

Onion Sauce. — Parboil the onions in water; strain them off, cover them with milk and let them boil gently half an hour; strain the milk off; chop the onions fine; put ½ oz. butter into the saucepan; when melted, stir smoothly in ½ oz. flour; add by degrees the milk; stir it till it thickens; then add the onions and let it boil.

Apple Sauce. — Pare four apples, quarter and core them; put them into a saucepan with a very little water, and sugar to taste. Boil gently till reduced to a smooth pulp, stirring occasionally.

Sweet Sauce, for Puddings, etc. — Put on half a pint of water to boil; mix one dessertspoonful of arrowroot or corn flour and one of sugar with a little cold water; flavor with a tablespoonful of jam or marmalade, or a few drops of vanilla or a glass of wine; pour it into the boiling water and strain over the pudding. It can be colored with cochineal.

Plain White Sauce. — 1 oz. flour; ½ pint milk; 1 teaspoonful sugar.

Break the flour gradually with the milk; stir over the fire till it boils; add the sugar; boil for three minutes.

Arrowroot Sauce. — ½ oz. arrowroot; ¼ pint water; 1 teaspoonful sugar.

Break the arrowroot with the water; stir over the fire till it boils; add the sugar; boil three minutes. A few drops of lemon-juice or other flavoring may be added. Corn flour may be used instead of arrowroot. If the sauce is wanted red, add three drops of cochineal.

Syrup Sauce. — Melted butter; 1 tablespoonful syrup.

Stir in the syrup (but do not boil) before the melted butter is removed from the fire.

Custard Sauce. — 1 yolk egg; ¼ pint milk; 1 teaspoonful corn flour; 1 teaspoonful sugar.

Break the corn flour with a little of the cold milk; stir the yolk in smoothly; heat the milk almost but not quite to the boiling point; pour it into the corn flour and egg, stirring constantly. The mixture may be returned to the pan for a few minutes to let it thicken; but on no account allow it to boil, as the yolk will curdle. Serve hot or cold.

Mint Sauce. — 1 dessertspoonful finely chopped fresh mint; 1 dessertspoonful brown sugar; ½ gill vinegar; ½ gill hot water.

Mix the sugar and hot water; let it cool; add the vinegar and chopped mint. Serve cold

Mustard Relish. — 1 dessertspoonful sugar; ½ teaspoonful made mustard; 2 dessertspoonfuls vinegar.

Mix the sugar and mustard smoothly together, then add the vinegar gradually, stirring till smooth.

Salad Sauce. — 1 hard-boiled egg; 2 tablespoonfuls oil; 1 tablespoonful vinegar; ½ teaspoonful made mustard; ¼ teaspoonful sugar; ¼ teaspoonful salt; 1 pinch of pepper.

Take the white from the yolk of the hard-boiled egg; rub the yolk, sugar, salt, pepper, and mustard smoothly together; stir in the oil gradually; then stir in the vinegar gradually, chop the white into small pieces; sprinkle it over the salad.

Cream or milk may be used instead of oil.

Cold Maitre d'Hotel Sauce. — Put about six ounces of fresh butter on a plate, knead it together with some chopped parsley, pepper, salt, and lemon-juice.

This butter is chiefly used for French beefsteaks, for broiled mackerel, and other sorts of broiled fish.

White Oyster Sauce. — Put the oysters into a stewpan, and set them to boil for five minutes on the stove-fire, drain them on a sieve (saving their liquor in a basin), wash and beard them, taking care to cut off the tendons, as that part when eaten is troublesome to the teeth, and put them into a stew-pan, reserving only the fat part; then put 4 oz. butter (more or less, according to the quantity of the sauce) into a stewpan with 2 oz. of flour, cayenne pepper, and salt; knead these well together, and moisten with the oyster liquor, some cream, and a piece of glaze; stir the sauce on the fire, keeping it boiling for ten minutes; then pass it through a sieve upon the oysters. Just before sending to table add a little lemon-juice.

Brown Oyster Sauce. — Prepare this precisely as the last sauce, but instead of the cream use an equal quantity of brown gravy. Brown oyster sauce is a very desirable accessory to beefsteaks, beef pudding, beefsteak pie, broiled slices of codfish, and various other plain dressed dishes.

Butter Sauce. — Butter sauce, or, as it is more often absurdly called, *melted butter*, is the foundation of the whole of the following sauces, and requires very great care in its preparation. Though simple, it is nevertheless a very useful and agreeable sauce when properly made; so far from this being usually the case, it is too generally left to assistants to prepare, as an insignificant matter; the result is therefore seldom satisfactory.

When a large quantity of butter sauce is required, put four ounces of fresh butter into a middle-sized stewpan, with some grated nutmeg and mignonette pepper; to these add 4 oz. of sifted flour; knead the whole well together, and moisten with a pint of cold spring water; stir the sauce on the fire till it boils, and after having kept it gently boiling for twenty minutes (observing that it be not thicker than the consistence of common white sauce), proceed to mix in one pound and a half of sweet fresh butter, taking care to stir the sauce quickly the whole time of the operation. Should it appear to turn oily, add now and then a spoonful of cold spring water; finish with the juice of half a lemon and salt to palate; then pass the sauce through a sieve into a large stewpan for use.

Note. — This kind of sauce should not be made above twenty minutes before it is wanted, as, from its particular delicacy, when exposed much longer to heat of any kind, it is liable to be decomposed. Should this occur, it may be remedied by simply adding a little cold spring water in winter, or a small piece of clean ice in summer, and then working the sauce briskly together with a spoon. This method is efficacious in restoring any sort of butter sauce, when turned or become oily, to its original smoothness.

Butter Sauce for Asparagus. — Prepare some sauce as directed in the foregoing recipe, and add a little double cream, with a teaspoonful of French vinegar.

This sauce is also served with cauliflower, broccoli, sea kale, salsify, etc.

Caper Sauce. — To about ½ pint of good butter sauce, add a teaspoonful of capers, with a little pepper and salt

Brawn Sauce. — Mix together 1 tablespoonful of moist sugar, 2 of vinegar, and 3 of salad oil, a teaspoonful of mixed mustard, some pepper and salt. Serve at once.

JELLIES.

Cow-Heel Jelly. — Take a cow-heel ready dressed, and boil it in 3 pints of water six hours. When cold, remove all the fat, put the jelly in a stewpan with the juice of 2 lemons and the rind of 1; 2 ounces of sugar, and the white and shell of 1 egg slightly beaten; and a little spice if preferred. A little saffron, 5 or 6 threads, gives it a nice color. Let it boil stirring all the time; place it on one side twenty minutes, then strain it through a cloth till clear. The foot itself is good either hot with onion sauce, or cold.

Ox-Foot Jelly. — 1 skinned ox-foot; ¼ lb. loaf sugar; 2 lemons; 1 white and shell of egg; 2 quarts water; ½ inch cinnamon stick; 2 cloves.

Remove all the fat from the foot; wash well in water; cut in four pieces. Put the pieces in a pan, covering them with cold water; bring to the boil, and throw away the water. Wash them again in cold water; put again into the pan, with 2 quarts of cold water; simmer slowly for 5 hours, skimming carefully. By this time it will be reduced to about 1 quart. Strain the liquid off into a bowl; let it become cold. When stiff remove all fat from the top. Then put this jelly into a pan with the cloves, cinnamon, sugar, juice of 2 lemons (keeping out the pips), and thinly pared rind of 1 lemon, the white and shell of 1 egg (slightly beaten together), and stir continuously till it almost boils. Draw the pan to the side of the fire, and let it stand till a thick scum is formed, then strain through a clean cloth. Fill a basin or mould with cold water, let it stand ten minutes, pour away the water and pour in the jelly. Let it stand until stiff. It is *nourishing* and *cooling*.

Calf's-Foot Jelly. — Prepare it in the same way as ox-foot jelly, using two calf's-feet instead of one ox-foot.

Bread Jelly. — A small loaf (stale); 1 quart water; 2 teaspoonfuls sugar.

Cut the loaf into thin slices; toast on both sides to a light brown. Put into a pan with the sugar and cold water. Simmer slowly till it becomes a jelly; strain while hot; serve hot alone, or mix with beef-tea, soup, tea, or coffee. This is quite nourishing.

Clarified Syrup, for Jellies. — To every pound of the finest loaf sugar, whatever quantity may be required, add rather more than a pint of spring water; and when the sugar is dissolved, add half the white of an egg whipped up with a little water; whisk the whole well together, set the stewpan on the stove fire, and as soon as the syrup begins to boil, set it down by the side of the fire to continue gently boiling, until it has thrown up all the scum; remove this as it rises to the surface, and then strain the syrup through a napkin into a basin, and keep it in a cool place for use.

To Clarify Isinglass.— First wash the isinglass in cold water, to free it from the dust that is apt to gather about it; then put it into a stewpan, and to every two ounces add half a pint of spring water and about one ounce of sugar; stir this on the stove fire till it boils, then throw in the juice of half a lemon and set the stewpan by the side of the stove, to continue gently boiling for about ten minutes, in order to dissolve the shreds of isinglass, and that it may thereby throw up all the scum, which should be removed as it rises to the surface; the isinglass may then be strained through a napkin into a basin, and used for the required purpose.

Isinglass may also be clarified by adding a very small quantity of whipped white of egg, after it has been dissolved in water as directed above, and then allowed to cool previously to mixing in the white of egg; it must then be allowed to boil gently by the side of the stove fire, and when perfectly cleared of all the scum should be strained through a napkin.

Note. — There are several kinds of *gelatine* in use, which serve the same purpose as isinglass, with more or less success; all these may be clarified in the same way as the above.

Filtering Juice for Jellies. — Wash several sheets of white blotting-paper (of the best quality) in cold water; then boil them in two quarts of water for about twenty minutes, strain the water from the paper, and pound it in a mortar until reduced to a fine pulp; mix this with a spoonful of washed white sand, then add both to the juice intended to be filtered, and throw the whole into a clean beaver jelly-bag. Pass the juice through the filtering bag until it drops as bright as spring water.

Orange Jelly à l'Anglaise. — Rub the rind of six oranges upon twelve ounces of the best loaf sugar, and put this into a basin; then squeeze the juice from a dozen ripe oranges and four lemons, and add this to the sugar. Next clarify 2 oz. of isinglass as directed, and mix this with the juice and sugar in a sugar boiler, add six drops of prepared cochineal, and stir the whole over the stove fire till the jelly becomes tepid; then strain it through a hair-sieve into a basin, and when it has become quite cold and is commencing to congeal on the surface and sides of the basin, stir it well together, and pour it into a mould previously embedded in rough ice. When the jelly is set firm, dip the mould in rather warm water, wipe it with a cloth, and turn it out carefully on its dish.

Lemon Jelly à l'Anglaise. — This is prepared in the same way as the above, substituting lemons for oranges; it will be necessary, however, to add four ounces of sugar on account of the acidity of the lemons.

Note. — Lemon Jelly *à la Française* is prepared in the same manner as the foregoing, except that the cochineal must be omitted.

Pineapple Jelly. — Peel a pineapple of about one pound weight, cut it into slices about a quarter of an inch thick, and put these into a basin. Clarify one pound of loaf sugar with a pint of spring water, the juice of two lemons, and half the white of an egg whipped with a little water; when thoroughly skimmed, strain the syrup on to the pineapple, allow it to boil for three minutes, then cover it down with a sheet of paper twisted round the basin, and allow the infusion to stand for several hours, in order to extract the flavor. When about to mix the jelly, strain the syrup through a napkin into a basin, and put the pieces of pineapple to drain upon a sieve; add two ounces of clarified isinglass to the pineapple syrup, and then pour the jelly into a mould previously embedded in rough ice.

Currant and Raspberry Jelly. — Pick the stalks from one quart of red currants and a pottle of raspberries, then put these into a large basin with half a pound of pounded sugar and a gill of spring water; bruise them thoroughly, by squeezing them with the back part of the bowl of a wooden spoon against the sides of the basin, then throw the whole into a beaver jelly-bag, and filter the juice, pouring it back into the bag until it runs through perfectly bright; next add half a pint of clarified syrup and two ounces of clarified isinglass to the juice, and pour the jelly into a mould placed in rough ice to receive it. This kind of jelly serves for the foundation of several others.

Strawberry Jelly. — Pick the stalks from two boxes scarlet strawberries, put these into a basin, and then pour one pint of clarified boiling syrup and half a pint of red-currant juice on to them; cover them down with a sheet of paper, tightly twisted round the edges of the basin, and allow the infusion to stand in a cool place until it becomes cold; then filter it through a beaver jelly-bag in the usual way, and when the whole has run through perfectly bright, mix it with two ounces of clarified isinglass and set the jelly in a mould, immersed in rough ice.

Cherry Jelly. — Pick the stalks from two pounds of ripe cherries and a handful of red currants, and pound them in the mortar in order to bruise the stones and kernels; then take them up and place them in a small preserving pan, with one pound of fine loaf sugar and half a pint of spring water; set this to boil on the stove fire for about five minutes, taking care to remove the scum as it rises to the surface: the whole must then be poured into a beaver jelly-bag, and filtered in the usual way. The juice should next be mixed with two ounces of clarified isinglass, and poured into a mould embedded in rough ice. The jelly may be garnished with cherries from which the stones are removed.

Mulberry Jelly. — This is prepared in the same way as strawberry jelly.

Macedoine of Fruits. — This may be made with every kind of jelly, which should be mixed with a variety of the most delicate fruits in season: these should be arranged with taste, so as to show their forms and colors to the best advantage. The fruits most appropriate for this purpose are peaches, nectarines, apricots, all kinds of plums, strawberries, raspberries, mulberries, red, white, and black currants, cherries, pears, oranges, pomegranates, grapes, etc.

Red-Currant Jelly. — Bruise one stick of cinnamon and twelve cloves, and put them into a small stewpan with two ounces of sugar, and the peel of one lemon pared off very thin, and perfectly free from any portion of white pulp; moisten with three glasses of port wine, and set the whole to simmer gently on the fire for a quarter of an hour; then strain it through a sieve into a small stewpan containing a pot of red-currant jelly. Just before sending the sauce to table, set it on the fire to boil, in order to melt the currant jelly, so that it may mix with the essence of spice, etc.

Black-Currant Jelly. — This sauce is made exactly in the same manner as the foregoing, substituting black-currant jelly for red; it is preferred by many to the other, as it possesses more flavor.

CHEAP DISHES WITHOUT MEAT.

Onion Cake. — *Required:* ¼ lb. scraps of bread; 1 large or 2 small onions (previously boiled); ½ oz. flour; ¼ teaspoonful powdered sage; 1½ oz. dripping; 2 tablespoonfuls milk; ¼ teaspoonful salt; 1 pinch pepper.

Soak the bread for an hour in cold water; pour off the water; bruise the bread with a fork till it is smooth. Chop the onion; mix all the ingredients well together, except 1 oz. of dripping. Grease a baking tin; place the mixture in it, and put the rest of the dripping in small pieces on the top. Bake in the oven for half an hour. Turn out of the tin, cut into four or six pieces. Serve hot or cold.

Savory Rice. — *Required:* 2 oz. rice; 1 large or 2 small onions (previously boiled); ½ oz. dripping; ½ pint pot liquor; teaspoonful salt; ¼ teaspoonful pepper.

Wash the rice; burst it; pour away the water. Chop the onion; add it, the pepper, salt, and liquor to the rice; simmer for a quarter of an hour till the rice is quite tender. Place on a dish; put the dripping in small pieces on the top; brown in the oven or before the fire. Serve hot.

Rice and Cheese. — *Required:* 2 oz. whole rice; 1 oz. grated cheese; 1 oz. dripping; about 1½ gill skim milk; 1 pinch salt; 1 pinch pepper.

Wash the rice; burst it; strain off the water. Place the milk, pepper, and salt in the pan with the rice; simmer for a quarter of an hour till the rice is quite tender; the mixture should not be so moist as for a pudding. Spread a thin layer of the rice on a flat dish; sprinkle half of the cheese over it; add the remainder of the rice, then the rest of the cheese over that. Place the dripping on the top in small pieces, and brown before the fire or in the oven; if browned in the oven, a little dripping should be placed at the bottom of the dish to prevent the rice and milk burning. Serve hot.

Sweet Rice Croquettes. — *Required:* 1 teacupful rice; ¼ lb. bread crumbs; 2 oz. sugar; small piece lemon rind; 1 pint milk; 1 egg; frying fat.

Wash the rice well; put it into a small saucepan; cover with cold water, and cause it to boil. When the water has been absorbed, add the lemon rind, and pour in the milk by degrees; simmer till quite soft and almost dry, stirring the rice very often. Add the sugar; mix well; remove the lemon rind; put the mixture on a plate to cool. Flour a corner of a board or table; form the rice into small shapes, and roll each in flour. When all the shapes are ready, break the egg on a plate, beat it with a fork; brush each piece with the egg; cover with bread crumbs; fry. When sufficiently cooked, place them on paper to dry; then pile them on a dish, dredging them over with white sugar.

Savory Rice Croquettes. — These are made in the same way as sweet croquettes, only the rice is cooked in water or stock instead of milk, and grated cheese, or onions boiled and chopped, added in place of sugar.

Savory Potatoes. — *Required:* 1 lb. boiled potatoes; 1½ oz. grated cheese; 1 oz. dripping or butter; 1 gill cold milk; ¼ teaspoonful salt; 1 pinch pepper.

Mash the potatoes (cold potatoes will do) till no lumps remain. Add the salt, pepper, milk, and half of the cheese; mix well. Place the potatoes smoothly in a small, greased pie-dish, sprinkle the remaining cheese on the top, also the dripping in small pieces; bake in a brisk oven or before the fire for a few minutes till it is a golden color. If it is possible to add on the top a little gravy from any roast meat, it will be found an improvement. Serve very hot.

Macaroni Cheese. — *Required:* ¼ lb. macaroni; 2 oz. grated cheese; ½ pint milk; 2 quarts hot water; 1¼ oz. dripping or butter; 1 oz flour; ½ teaspoonful salt.

Break the macaroni into small pieces; put them into a saucepan of hot water; leave the pan uncovered, and boil fast for half an hour; strain off the water. Melt 1 oz. dripping in a small pan; remove from the fire, add the flour, mix well with a wooden spoon. Pour in the milk very slowly, stirring constantly; add the salt, and 1 oz. grated cheese; stir over a slow fire till the sauce boils, then pour it into a basin and mix well with the macaroni Grease an oval tin dish (flat); put the macaroni and sauce into it; sprinkle the remaining cheese over it, and bake in rather a quick oven, or in front of the fire till brown. Serve very hot.

VEGETABLES.

Potatoes. *How to cook a Potato.* — Potatoes vary greatly in quality. Some potatoes are best boiled, and some steamed; some do best cooked in their skins, and some require peeling first; some cook in twenty minutes, some in thirty; others will only bake. As a general rule, it is more economical to boil potatoes in their skins; but they must be boiled gently, and the water strained off directly after they are done, for if they break in the water there is great waste. The skins must be carefully scrubbed quite clean before they are boiled When potatoes are very old, they acquire an unpleasant taste if boiled in their skins. Potatoes must never be boiled hard; they are best put into cold water with plenty of salt. New potatoes are put in boiling water, and take longer to boil than old potatoes. Potatoes take longer to steam than to boil. They take about an hour to bake. To see if they are done, run a fork into them.

Greens, Savoys, and **Cabbages** must be boiled in plenty of water, with a teaspoonful of salt to every half-gallon. They must be kept well stirred; and if boiled with the lid off, will want no soda to keep them green unless the water is very hard. The time required to cook them depends upon their age. The stalk should be split, so that it gets done as soon as the green part.

Peas want plenty of water with salt in; soda makes their outer skin crack. They take from fifteen to thirty minutes.

French Beans are split or sliced, and if old, strung before boiling. Boil with the lid off.

Summer Succotash. — Put beans into water with a piece of pork; allow at least an hour and a half for boiling; cut the corn from the cob, taking care not to cut down to the chits, then scrape the pulp off and put the cobs in with the beans to boil, as there is much sweetness in them. Half an hour before the dinner should be ready, take the cobs out and put in the corn. Liquor just enough to cover the whole is sufficient, taking care that it does not burn. As you send it to table, add salt and butter to suit your taste.

Winter Succotash. — In the winter take equal quantities of beans and corn, and put them soaking over night in separate vessels. The water with the beans may be changed, but that with the corn must not be, but must be kept scalding all the forenoon. Proceed with the beans as directed for summer succotash, adding the corn but a few minutes before you want it for the table. These were old methods. The corn is better dried on the cob, after scalding. In this case a few pieces of husks may be left on to hang it up by. The clothes-line is a good place to dry it; it will require several days. When wanted for use, soak it over night on the cob, and, instead of shelling it, cut it off in the same way as done in summer; by so doing you avoid the hulls and chits of the kernels.

Carrots, Turnips, Parsnips, and Spanish Onions. — Carrots are scraped; turnips peeled thickly to get below the woody fibre; parsnips peeled thin or scraped. These roots are generally boiled with meat. If boiled alone, put two ounces of salt to a gallon of water. When put into boiling water, parsnips, onions, and carrots take over an hour; turnips, half an hour. Turnips are mashed.

Onions before cooking should be peeled, placed in a basin with boiling water enough to cover; add a piece of washing powder as large as a pea; in fifteen minutes the water will be green, — throw this away, and cook the onions.

Spinach should be well washed, then packed closely into a saucepan and boiled in its own juice. When tender, squeeze dry, chop fine, return to the saucepan, and warm up with a piece of butter.

Cauliflower must be soaked in salt and water to get out caterpillars, etc. Put it into boiling water, and boil from twenty to thirty minutes. Serve with melted butter.

German Potatoes. — Choose large potatoes, scrub them clean, cut a slice off the top, scoop out a hole in the middle, fill it with half a sausage, put the top on again, and bake in a moderate oven.

Potato Cake. — 1 lb. cold potatoes, ¼ lb flour or oatmeal, ½ gill of warm milk (with ¼ oz. yeast dissolved in it, if you have it), a little salt, and butter. Mash the potatoes, add the other things, roll out the paste an inch and a half or two inches thick, lay it in a greased tin and bake it.

Green Corn. — Boil twenty-five minutes if very young and tender. As it grows older, it requires a longer time. Send to the table in a napkin.

Boiled Parsnips and Carrots. — Scrape very clean, and cut lengthwise into slices. Put them into a stewpan, and cover with water, and boil one hour. Serve with a little drawn butter.

Boston Baked Beans. — Soak them over night, parboiling them the next morning in the same water; turn that off, add water, and parboil again; the third time add water, and boil until you can separate the skins, when holding up in a spoon, by blowing; then they are ready to put into the brown earthen bean-pot or crock, which, by the way, is considered necessary to keep them moist (they are not as nice baked in tin); turn on one tablespoonful of molasses, which flavors and gives them a rich color; then score a piece of pork that just fits into the top of the pot, and bake all day in a moderate oven, adding water occasionally if needed. They are ready for supper Saturday night, and breakfast Sunday morning.

PUDDINGS, ETC.

Yorkshire Pudding. — To every ¼ lb. flour, allow 1 egg and ½ pint of milk. Break the egg into the flour, and mix quite smoothly with a little of the milk; beat it well, let there be no lumps in it; add the remainder of the milk by degrees; put the pudding tin under the meat to catch some dripping, then pour in the pudding and bake half-hour.

Suet Pudding. — Chop fine ½ lb. suet, mix with 1 lb. flour, 1 teaspoonful baking powder, a pinch of salt, make into a stiff dough with cold water or milk. Dip a pudding cloth in boiling water, dredge well with flour, put in the pudding, tie securely, but leave it room to swell. Boil in plenty of water one hour and a half. Or grease a pint and a half basin and put it in, tie a cloth over and boil two hours.

Norfolk Dumplings. — Mix ½ lb. flour with ½ teaspoonful of baking powder and a pinch of salt; make into a light dough with cold water; form into small balls, put them into boiling water immediately, and boil for twenty minutes.

Baked Apple Dumplings. — Same crust as above; peel six apples and core them without dividing them, divide the crust into six pieces, lay an apple on each, and work the crust over it till the apple is covered without cracks. Bake a half-hour.

Patties. — Put ½ lb. flour into a basin, mix in ½ teaspoonful baking powder, mix it into a stiff paste with cold water (half the yolk of an egg with it makes it richer), flour your board and pin, roll it out very thin, spread ¼ lb. butter, lard, or dripping on as if spreading butter on bread, sprinkle a little flour on it, cut it in eighths, lay the pieces on the top of each other, flour the edges, roll it out again, fold it, roll it out one third of an inch thick, grease your patty pans, cut rounds of paste a little larger, lay them in, fill them with meat cut in dice and seasoned to taste, sprinkle a little water on, cover, press the edges together, trim neatly, and if you have an egg broken, brush them over with it. This flaky crust can be made with one third or even one fourth of fat or shortening.

Baked Plum Pudding. — Chop fine ¼ lb. suet, put it into ¾ lb. flour with a teaspoonful of baking powder, pick ¼ lb. plums and chop them, wash, dry, and pick ¼ lb. currants, 2 oz. peel and 2 oz. moist sugar, and a pinch of mixed spice, mix into a stiff paste with an egg beaten up in a gill or more of milk. It should be so stiff that a spoon could stand up in it. Bake in a greased tin one hour.

Baked Custard. — To the yolks of 4 eggs beaten lightly with a little sugar pour 1 pint of boiling milk, flavor to taste, line a dish with a little piece of pie-crust, pour in the custard, and bake three quarters of an hour. A common one can be made of two whole eggs.

Bread Pudding. — Soak ½ lb. pieces of bread in cold water; any crust however stale will do, provided it is not mouldy nor burnt. Squeeze them dry, and pour on them 1 quart boiling milk. Cover, and let them swell. Beat up 2 eggs with 2 oz. sugar, stir into the pudding, put in ¼ lb. plums or currants. Bake in a greased dish half an hour. This pudding can be boiled in a buttered basin. Time required, two hours.

Sago, Tapioca, or Rice Pudding — Soak two tablespoonfuls in a pint of milk, put it on to boil, stirring it to prevent its sticking; mix in (off the fire) one egg and one tablespoonful of sugar. Bake in a greased dish.

Lemon Pudding. — *Required:* The juice and grated rind (rubbed on sugar) of 6 lemons, a pint of cream, 6 oz. bruised ratafias, 12 yolks and the whites of 4 eggs, whipped, half a nutmeg grated, a little cinnamon powder, 12 oz. pounded sugar, and a very little salt. Mix in a large basin all the above together, and work the ingredients together with a whisk for about ten minutes. Next put a border of puff-paste round the edge of a tart dish, spread the dish with butter, pour the batter into it, strew some shred pistachio kernels on the top, and bake it for about half an hour (at moderate heat). When done, shake some sifted sugar over it, and serve.

Orange Pudding. — This is made as the above; double the quantity of oranges may be used for this purpose, owing to their not containing so much acid as lemons, but the rind of three will suffice for the zest.

BOILED PUDDINGS.

Boiled puddings are generally shortened or made light with suet. Where people cannot eat suet, butter may be used in its place. Boiled puddings are lighter if boiled in a cloth, but easier to keep in shape if boiled in a basin; but they require a longer time to boil. It is most essential to keep a pudding cloth clean; it should be washed in two or three hot waters without soap, immediately it is done with, wrung dry, and dried off quickly, or it will get a musty taste. Always put the saucepan of water on to boil before you begin to make a pudding.

Meat Pudding. — A quart basin holds 2 lbs. meat; 1½ lbs. steak or beef skirts and ½ lb. kidney make a good pudding. Make a crust of ¼ lb. suet chopped fine, 1 lb. flour, a pinch of salt, a teaspoonful of baking powder, mixed together, and sufficient cold water to make a stiff paste. Cut off one third for the cover. Roll the rest to a round twice the size of the top of the basin; grease the basin, and lay it neatly in. Fill it with the meat cut in slices and seasoned with pepper and salt, pour in a little water, wet the edges of the paste, roll out the cover the proper size, lay it on, press the edges together, trim neatly. Dip the cloth in boiling water, flour it, tie it on, tie up the edges, and put it in boiling water. Let the pudding boil two hours and a half. It can be made commoner with one third suet, or even a quarter instead of half.

Batter and Black-Cap Puddings. — 8 oz. flour, ½ teaspoonful of baking powder, 2 eggs, a pint of milk. Mix the flour with the baking powder and a pinch of salt. Break the eggs into a cup, beat them lightly with a little of the milk, mix them by degrees quite smoothly into the flour so that there are no lumps, add the rest of the milk, grease a basin, pour the pudding in through a strainer; flour the cloth thickly after dipping it in boiling water, tie it securely, and boil gently for an hour and a half.

Black-cap pudding is made by throwing in ¼ lb. currants after the batter is in the basin.

Fruit and Roly-poly Puddings. — The crust for these should be the same as for meat puddings. Allow ¼ lb. sugar to a quart of fruit. For roly-poly, roll the crust out thin, cover it with jam, treacle, or currants, apple, and sugar; roll it up, tie in a cloth securely at each end, and boil an hour and a half.

Plum Pudding. — ¼ lb. suet chopped fine, ¼ lb. currants, ¼ lb. plums, ¼ lb. sugar, 6 oz. flour, 6 oz. bread crumbs, 2 oz. peel, a gill of milk, 2 eggs, ½ teaspoonful of baking powder. Mix thoroughly the dry things, beat the eggs lightly with the milk, add to them, dip a cloth in boiling water, flour it, tie in the pudding securely, leaving it room to swell, and boil two hours and a half.

Syrup Pudding. — 1 lb. flour, a teaspoonful of baking powder, ¼ lb. suet chopped fine, ¼ lb. syrup, an egg, 1½ gills milk. Mix the dry ingredients, stir the egg and milk into the syrup and mix with them, pour into a greased basin, tie a well-floured cloth over, and boil two hours.

Plum Pudding. — ¾ lb. raisins, ¾ lb. currants, ½ lb. candied orange, lemon, and citron, 1¼ lbs. chopped beef suet, 1 lb. flour, ¾ lb. moist sugar, 4 eggs, about 3 gills milk, the grated rind of 2 lemons, ½ oz. nutmeg, cinnamon, and cloves (in powder), a glass of brandy, and a very little salt.

Mix the above ingredients thoroughly together in a large basin several hours before the pudding is to be boiled; pour them into a mould spread with butter, which should be tied up in a cloth. The pudding must then be boiled for four hours and a half; when done, dish it up with a custard-sauce spread over it.

Tapioca Pudding. — 10 oz. tapioca, a quart of milk, 6 oz. sugar, 6 yolks of eggs and 2 whipped whites, the grated rind of a lemon, 2 oz. butter, and a little salt.

Put the tapioca, sugar, butter, salt, grated lemon, and the milk into a stewpan; stir this over the fire until it boils; then cover the stewpan with its lid, and set it on a very slow stove fire (partially smothered with ashes), to continue gently simmering for a quarter of an hour. The tapioca should then be withdrawn from the fire, and after the six yolks and the two whipped whites of eggs have been thoroughly incorporated in it, pour the preparation into a mould or pudding basin previously spread with butter; steam the pudding for about an hour and a half, and when done, dish it up with either a plain arrowroot or custard sauce over it.

Sago or semolina may be prepared in the same manner.

Note. — These may be either steamed in a mould or pudding basin, or baked in a pie dish.

Ginger Pudding. — *Required:* 6 oz. flour, 6 oz. sugar, 6 eggs, 8 oz. preserved ginger, a pint of cream, six ounces of butter, a little salt.

Put the cream, sugar, butter, and salt into a stewpan on the fire, and as soon as these begin to simmer, take off the stewpan, throw in the flour, and stir the whole together quickly; then put this paste back again on the fire, and continue stirring it for about five minutes; it must then be withdrawn, and the six eggs mixed in gradually with it. The ginger, cut into small pieces, must now be added to the preparation, which must then be poured into the mould previously spread with butter. Steam it for an hour and a half, and when done, dish up the pudding with a custard sauce made with the syrup from the ginger.

Pineapple Pudding is made in the same manner as the above, pineapple being used for ginger.

Bread Pudding, Plain. — 12 oz. bread-crumbs, 6 oz. sugar, 2 oz. butter, a pint of milk, the rind of a lemon rubbed on a piece of loaf-sugar, 6 yolks of eggs, and 2 whites whipped, and a little salt.

Put the bread crumbs into a basin with the sugar, butter, lemon sugar, and salt; then pour in the milk boiling, cover up the whole, and leave it to steep for about ten minutes; the eggs may then be added, and after the whole has been well mixed together, pour the preparation into a mould or pudding basin, previously spread with butter. Steam the pudding for about an hour, and when done, dish it up with some arrowroot sauce made as follows: Mix a dessertspoonful of arrowroot with twice that quantity of sugar, half the juice of a lemon, a little nutmeg, and a gill of water, and stir this over the fire until it boils.

Apple Pudding. — Peel two dozen russets, remove the cores, and cut them up in slices; then put the apples into a deep saucepan with 4 oz. butter, the rind of 2 lemons, 12 oz. pounded sugar, and 1 lb. apricot jam; toss the whole over a slow stove fire until the apples begin to dissolve, and then set them aside to cool. Next line a good-sized pudding basin with some light-made suet paste, fill this with the prepared apples, place a covering of paste on the top, fasten it down securely, and then steam it in the usual manner for about two hours. When the pudding is done, dish it up, pour some warm apricot jam over it, and serve.

Cabinet Pudding. — Spread the inside of a plain mould with butter, and ornament the sides with dried cherries and candied citron; fill the mould with alternate layers of slices of sponge cakes and ratafias or macaroons; then fill up the mould with a lemon custard made with 8 yolks of eggs, 1 pint milk or cream, 6 oz. sugar, a glass of brandy, and the grated rind of a lemon. This custard must not be set, but merely mixed up. Steam the pudding in the usual way, for about an hour and a half, and when done, dish it up either with arrowroot sauce or a custard.

Apple Trifle. — Scald as many apples when pulped as will cover the dish you design to use to the depth of two or three inches; before you place them in the dish, add to them the rind of half a lemon grated fine, and sugar to taste; mix ½ pint of milk, ½ pint of cream, and the yolk of an egg; scald it over the fire; keep stirring and do not let it boil; add a little sugar and let it stand till cold, then lay it over the apples, and finish with the cream whip.

Lemon Custard Pie. — Yolks of 3 eggs, beaten with ½ cup sugar, 1 cup milk, flavor with lemon ; bake this ; make crust the same as any pie, and put this in and bake ; then take whites of 3 eggs, beat to froth, 2 tablespoonfuls powdered sugar ; when the first is baked, turn this on and bake over.

Cream Pie. — 3 eggs, 1 cup sugar, 3 tablespoonfuls melted butter, 6 teaspoonfuls sweet milk, 1 heaped cup flour, 1½ teaspoonfuls yeast powder ; beat together and bake in two pans ; when done, divide, and fill with cream or jelly. One pint of milk, 1 egg, 1 tablespoonful flour ; when boiled, add a little vanilla or lemon.

Orange Pie. — 3 eggs, ¾ cup white sugar, 2 tablespoonfuls butter, juice and grated rind of half an orange, juice and grated rind of half a lemon, nutmeg to taste. Beat butter and sugar together well, then beat in the yolks of the eggs, and the orange and lemon ; put into pastry without top crust and bake. When done spread over them the whites of the eggs beaten stiff with powdered sugar ; return to the oven a few minutes to brown.

Lemon Cream Pie. — 1 teacupful powdered sugar, 1 tablespoonful butter, 1 egg, juice and grated rind of 1 lemon, 1 teacupful boiling water, 1 tablespoonful corn starch dissolved in cold water ; stir the corn starch into the hot water, add the butter and sugar well beaten together ; when cold add the lemon and beaten egg. Bake in open tart without top crust.

Chocolate Pie. — 1 cup sugar, 2 cups flour, ½ cup milk, ½ cup butter, 2 eggs, 1 teaspoonful yeast powder, bake in three thin cakes. For filling, dissolve one square chocolate, beat the whites of three eggs, and add about 1 cup of sugar. Spread between the cakes and over the top ; set in the oven a few minutes.

Cheap and good Cream Pies. — 1 egg, 1 cup sugar, 1 cup milk, small piece of butter, 2 teaspoonfuls cream tartar, 1 teaspoonful soda, a little salt, 2 cups flour. Beat butter and sugar together, add the egg and beat again thoroughly, then add the other ingredients. Bake in Washington-pie tins.

Mock Mince Pie. — 4 crackers rolled, 2 eggs, 1 large cup sugar, 1 cup molasses, 1 cup boiling water, ½ cup butter, 1 cup vinegar, 1 teaspoonful all kinds of spice, raisins. This is enough for three pies.

Raisin Pie. — 1 cup raisins chopped, 1 cup sugar, 1 egg, 1 cracker rolled, juice of 1 lemon, water enough to cover ; boil together. This makes a very nice pie.

Cream for the Above. — 1 pint milk set in a kettle of boiling water. Beat together 1 egg, ⅔ cup sugar, ½ cup flour, a little salt. Stir this into the milk when near boiling, and let it cook there a few minutes. When cool, flavor to taste.

Prune Pie. — 2 cups French prunes, steeped in water over night, 1 cup sugar, 1 teaspoonful extract lemon, 1 tablespoonful vinegar, ½ cup water. Wet the edges of the paste with milk. Bake twenty-five minutes in rather hot oven.

Mince Pies. — 5 lbs. boiled beef, 4 lbs. suet, 5 lbs. raisins, 5 lbs. sugar, 1 lb. citron, 8 crackers rolled fine, 2 lemons chopped fine, 3 pints cider, 1 quart molasses, 1 quart wine, 1 quart brandy, 1 quince boiled and chopped, 10 apples chopped, 2 tablespoonfuls salt, 8 teaspoonfuls clove, 13 teaspoonfuls cinnamon, 4 teaspoonfuls mace. Add bits of butter and more sugar before baking the pies. Mix molasses, apples, crackers, cider, and spices together. Scald them, then mix them with the other ingredients. These are very rich pies.

Lemon Pie, No. 1. — Juice and grated rind of 1 lemon, 2 eggs, 1 cup of sugar, 2 tablespoonfuls flour, a little salt. Beat together. Add milk enough to fill the plate Frost it.

Lemon Pie, No. 2. — Juice and grated rind of 3 lemons, 3 eggs, 3 tablespoonfuls sugar to a lemon. No top crust.

Pumpkin Pie. — 1 quart stewed pumpkin, strained through a sieve ; 9 eggs, whites and yolks beaten separately ; 2 quarts milk, 1½ cups sugar, 1 teaspoonful cinnamon and mace. Beat well and bake without top crust.

Frosted Pie.— Line a deep plate with crust and bake it. A large pint of milk, let it boil ; mix the yolks of 3 eggs, ⅔ cup sugar, 1½ tablespoonfuls corn starch, 1 teaspoonful extract of lemon, little salt. Stir in the milk while boiling, then fill the crust. Beat the whites stiff enough to spread and place in the oven ; bring to a delicate brown.

Cocoanut Pie. — 1 cup prepared cocoanut soaked in a pint of boiled milk, 2 tablespoonfuls corn starch, yolks of 3 eggs, little butter and salt, add sugar if wanted ; grated rind of lemon improves. Bake without upper crust. Take the whites of the eggs for frosting.

Cranberry Pie. — 1 cup cranberries cut in halves, 1 cup sugar, sprinkle over the berries 1 tablespoonful flour, add ½ cup of water.

Date Pie. — 1 lb. dates boiled, 3 pints milk, 3 eggs, 3 tablespoonfuls sugar, spice to taste. Put dates into the milk warm, and sift them. Bake like custard.

Rhubarb and Raisin Pie. — 2 cups chopped rhubarb, one cup chopped raisins, 1 cup sugar, little cinnamon.

Fruit Pie. — Pie-crust is made either short or flaky according to the way the fat (whether it be butter, lard, suet, or dripping) is put into the flour. For short crust, it is rubbed into the flour before the flower is wetted; for flaky, it is rolled in afterwards. Short crust is the easiest for beginners. Take ½ lb. flour, mix with it ½ teaspoonful baking powder, and rub lightly into it a ¼ lb. butter or dripping or lard. (Suet crust is better for boiling; but is not good to eat cold.) Wet it with sufficient cold water to make a stiff paste; the quantity required depends on the quality of the flour. Roll it out two inches larger than the pie dish it is to cover, fill the dish with fruit, put 4 tablespoonfuls moist sugar to a quart of fruit. For dry fruit, as apples and plums and green gooseberries, put in ½ gill of water; juicy fruit requires none. Cut a strip all around your paste to lay on the edge of your pie-dish, moisten it slightly, lay on your cover, press the edges together, trim them neatly, sprinkle a little water over the top, grate a little sugar over, and bake half an hour in a moderate oven. This crust would be made richer by mixing the yolk of an egg with the water, and commoner by using only one third as much lard or dripping as flour, instead of half.

Common Paste. — Rub 8 oz. fresh butter well into 20 oz. flour; make this into a smooth paste with water (say ⅓ to ½ pint), roll out twice or thrice and use by adding to the flour 2 or 3 oz. of finely powdered sugar (before the water but after the butter); this paste is very suitable for fruit tarts.

CAKE.

White Cake. — Take 1 cup butter, 3 cups white sugar, 5 cups flour (measured after sifting), 1 cup sweet milk, the whites of 1 doz. eggs, and 2 teaspoonfuls baking powder. Cream the sugar and butter together, then add the well-beaten whites of eggs and the flour alternately. Flavor with lemon and bake immediately.

Delicate Cake in Cup Measure. — 1½ cups powdered sugar, ½ cup butter, ½ cup milk, 4 eggs, ½ teaspoonful soda, 1 teaspoonful cream tartar, and 2 cups flour.

Frosting for Cake. — To the white of 1 egg beaten to a froth, add 2 heaping teaspoonfuls corn starch, and as much dry powdered sugar as you can stir in. Bake your cake first, then make your frosting, then remove the cake from your baking pan and spread the frosting over the top of the loaf, making it smooth with a knife or spoon, and put it in a warm (not hot) oven until it hardens, so that the frosting will not adhere to the finger in touching it; take it out and put in a cool, dry place, and it will be hard enough to cut in a few hours. The above makes one loaf.

Soft Gingerbread. — 1 cup molasses, 1 cup boiling water, 1 tablespoonful butter, 1 teaspoonful each of soda and ginger, and a pint flour.

Plain Cake. — Mix thoroughly 1 cup sugar and a small tablespoonful butter, add 1 cup buttermilk or sour milk, 2 cups flour, and ½ teaspoonful soda. Flavor with lemon. This cake is more tender when a few days old than when first baked.

Sally Lunn. — 1 pint warm milk, a piece butter the size of an egg, 3 eggs, 1 teacup sugar, flour to make a stiff batter, ½ pint good yeast, and set to rise. This makes nice muffins, leaving out the sugar.

Training Gingerbread. — 1 pint nice, light-colored molasses, 3½ oz. butter, ½ oz. saleratus, ¼ oz. alum, and ½ oz. ginger. Work the butter into some flour, dissolve the alum in ½ pint water, work in flour enough to roll, and bake in sheets the thickness of bakers' gingerbread.

Chocolate Cake. — Beat to a cream 1½ cups sugar, with ½ cup butter. Beat yolks and whites of 3 eggs, ½ cup milk, ½ teaspoonful soda dissolved in the milk; add 8 tablespoonfuls grated chocolate, 3 full of sugar, 2 of scalded milk, dissolved together by steaming ovor a teakettle. Then add 2 cups flour, with 1 teaspoonful cream tartar. Frost the top with white frosting.

Cheap Fruit Cake. — 4 cups flour, 2 cups sugar, 1 cup butter, 1 cup milk, 2 cups raisins, 2 cups citron, 3 eggs, ½ teaspoonful soda, nutmeg.

Feather Cake. — 1 egg, 1 cup sugar, 1 cup milk, 2 cups flour, 1 teaspoonful cream tartar, ½ teaspoonful soda.

Hard Sugar Gingerbread. — One cup butter, 2 cups sugar, 6 cups flour, 3 eggs, 3 tablespoonfuls milk, 1 teaspoonful soda, 2 teaspoonfuls cream tartar, 1 teaspoonful ginger. Roll thin, cut in small cakes, and bake in a quick oven.

Huckleberry Cake. — 2 cupfuls sugar, 1 of butter, 5 eggs, 1 cupful milk, 1 teaspoonful soda, 1 small lemon, a little nutmeg, a wineglassful brandy, 3 cupfuls flour; dredge a quart of huckleberries thickly with flour and add the last thing.

Ice Cream. — Boil 1 quart of cream, 4 eggs, 1 cup of sugar well beaten, stir into the boiling cream, do not let it boil. Lemon or vanilla, etc., to taste.

Chocolate Ice Cream. — 1 quart cream, 1 pint new milk, 1 lb sugar, 2 well-beaten eggs, 5 table spoonfuls grated chocolate rubbed smooth in a little milk, flavor to taste; heat the milk almost to boiling, pour it by degrees in with the beaten egg and sugar, and freeze.

Floating Island. — 1 quart milk, boil, stir in the beaten yolks of 6 eggs, flavor with lemon or vanilla, 1 cup sugar; whip the whites of the eggs to a strong froth. When the custard is thick, put in a deep dish, heap the frothed eggs on top.

Dish of Snow. — 1 quart cream, 3 eggs, 2 tablespoonfuls sugar, 4 spoonfuls sweet wine, 1 teaspoonful essence of lemon, whip to a froth.

Sugar Apple Butter. — Stew sour dried apples until soft and the juice nearly absorbed; let them cool sufficiently to rub through a colander, which done, measure, and to every 4 cups of apple allow 1 heaping cup of sugar; spice to taste (not too highly) with whatever spice preferred, and simmer down until quite thick, taking care not to burn it. Make it in a porcelain kettle. Were a large quantity to be made, it might keep better with more sugar.

But probably the way of making apple butter practised by our grandmothers is the best and the cheapest: —

Connecticut Apple Butter. — Take new cider made from sweet apples, and before it has in the slightest degree fermented, boil it until thick enough (four pailfuls into one, if the cider be pure apple juice, is about right), removing any scum that may arise while boiling; then add sweet apples, pared and cored, a heaping half-bushel of quarters to 3 gallons boiled cider; boil slowly, stirring frequently until thoroughly stewed; let them cool sufficiently, and rub all through a colander; then, having washed the kettle, return to it the sauce, add 1 oz. cinnamon, ½ oz. cloves, both ground, and half a nutmeg, grated. Simmer it half an hour or so, stirring frequently to prevent burning.

Fruit butter should be of the consistency of jam. The rule for trying it is to put a spoonful on a plate, let it cool quickly, and if the juice separates from the fruit it should be cooked more, but if the fruit holds the juice and the top has a smooth, glistening appearance, it is done, and will keep a long time if well covered and kept in a cool place.

Coffee Cream. — Roast 8 oz. Mocha coffee berries in a small preserving pan over a stove fire, stirring it the whole time with a wooden spoon, until it assumes a light-brown color; then blow away the small burnt particles and throw the roasted coffee into a stewpan containing a pint of boiling milk or cream; put the lid on the stewpan, and set it aside to allow the infusion to draw out the flavor of the coffee. Next strain this through a napkin into a stewpan containing 8 yolks of eggs and 12 oz. sugar, add a very small pinch of salt, stir the cream over the stove fire until it begins to thicken, then quicken the motions of the spoon, and when the yolks of eggs are sufficiently set, strain the cream through a tammy or sieve into a large basin. Mix ½ pint of whipped cream and 1½ oz. clarified isinglass in with this, pour the whole into a mould ready set in rough ice for the purpose, and when the cream has become firm, dip the mould in warm water, and turn the cream out on its dish.

Chocolate Cream. — Grate 8 oz. vanilla chocolate, put this into a stewpan with 8 oz. sugar, 8 yolks of eggs, and a pint of cream; stir the whole over a stove fire until the preparation begins to thicken, and the yolks of the eggs are sufficiently set without allowing them to curdle; strain them through a tammy, with pressure, into a basin; add ½ pint whipped cream and 1½ oz. clarified isinglass; mix the whole well together, and pour it into a mould previously embedded in rough ice, to receive it.

Charlotte Russe. — 1 oz. gelatine, 2 tablespoonfuls water, set on stove to melt. Beat 1 pint pure cream in a bowl till it is thick, put in 2 tablespoonfuls sugar, add the melted gelatine. Line the mould with sponge cake baked thin. Pour in the cream, and set it on ice till cold.

Simple Mead. — 1 part of honey is dissolved in 3 parts of water, and boiled over a moderate fire till it is reduced to ⅔ of the quantity. It is then skimmed and put into a vessel, which must be quite full; it is allowed to subside for 3 or 4 days, and then drawn off for use. To make it from combs from which honey has been drained, they are to be beaten in warm water, and after the liquor has subsided it is to be strained.

The cottagers in Scotland make an excellent beer by adding a little yeast to the strained liquor, allowing it to ferment for a few days in a cask, and then bottling it.

PICKLES.

Cabbage. — Slice into a colander, and sprinkle salt over each layer. Drain two days, put into a jar, and cover with boiling vinegar, adding a few slices of red beet-root. If spice be used, it should be boiled with the vinegar. *Hard white cabbage* may be intermixed with the other, or cauliflowers cut into branches. *Cauliflowers, broccoli, beans, nasturtiums, artichokes, radishes,* etc., may be pickled in the same way.

Walnuts. — Take green walnuts before the inner shell is formed, which may be known by pricking them with a pin; if it goes through easily, they are young enough to pickle. Prick them in several places, to allow them to imbibe the salt, and keep them in strong brine for a fortnight, making fresh salt and water every three days; drain and put them in a jar, sprinkle with salt, and pour over boiling vinegar; some shallots, garlic, or onion may be boiled in the vinegar if the flavor be not disliked.

Onions. — Select young, equal-sized onions, peel and steep them in strong salt and water for four days, changing the water two or three times; wipe perfectly dry, and put them into scalding milk; when the milk becomes cold, drain them, and dry each separately in a cloth; put into jars; pour over as much white wine vinegar, which has been boiled with white pepper, as will cover them; tie over first with wet bladder, and then with leather, and keep the jars in a dry place for use. A little powdered or crushed ginger may be added, if desired.

LEMONS.

Lemons are very healthy, and should be made an article of our food when possible. There is hardly any baked, boiled, or fried dish of meat, fish, or eggs that a slice or two of lemon will not improve. Lemonade is one of the best and safest drinks, whether sick or well, and in most cases it is beneficial to the stomach. Ink stains are almost instantly removed by lemon juice. Lemons may be kept for a long time in water, if the same is changed once a week.

MEAT AND APPROPRIATE "FIXINS."

Broiled mutton chops, sliced lemons or mushrooms.
Roast goose, apple sauce.
Salmon, green peas and melted butter.
Broiled shad, boiled rice and salad.
Boiled bluefish, maitre d'hotel sauce.
Broiled fresh mackerel, gooseberry sauce.
Venison or game, cranberry or currant jelly.
Roast beef, boiled onions and horseradish.
Boiled turkey, oyster sauce.
Roast pork, apple sauce.
Roast veal, tomato or mushroom sauce.
Roast mutton, cranberry or currant sauce.
Boiled mutton, caper sauce.
Roast turkey, cranberry sauce.
Boiled halibut, egg sauce and baked apples.

TERMS USED IN MODERN COOKERY.

To *break* flour is to mix in very gradually a small quantity of cold liquid, stirring it until it is smooth.

To *bind* a mixture is to add milk or eggs to make it hold together.

To *brown* meat, etc., is to place it in a small quantity of hot fat, and not turn it until the part is brown.

To *burst* rice is to put it on in cold water and bring it to the boil. This bursts the grains of starch.

To *clean* currants is to rub them (the stalks being previously picked) in a damp cloth till clean, or to sprinkle a little flour over them and rub them in a dry, rough cloth.

To *core* is to remove the heart of an apple or pear; this is either done when the apple is whole with a special utensil called a corer, or after it is quartered with a knife.

To *grease* a dish, paper, etc., is to rub soft fat, such as dripping or butter, over it. It is best to grease a dish with the fingers or a piece of paper, and to spread the fat on paper with a knife.

To *parboil* is to boil anything until half cooked.

To *scald* vegetables, etc., is to pour boiling water over them for a few minutes, and then throw away the water.

To *scald* milk is to bring it almost, but not quite, to a boil.

To *shred* suet is to cut it with a sharp knife so thinly as to be almost scraping; the suet should be so thin as to curl up.

To *wash* rice, barley, etc., is to pour cold water over them, stir and pour off the water, repeating this till the water poured off is quite clear.

Aspic. — A transparent jelly used as an outer moulding for fish, game, poultry, etc.; also for decorating and garnishing.

Assiette (a plate). — Small entrées, not more than a plate will hold. Fruits, cheese, chestnuts, biscuits, etc., at dessert, if served upon a plate, are called *assiettes*.

Assiette Volante. — A dish handed round by a servant, but not placed on the table. Small cheese *soufflés*, and other dishes, served hot, are often made *assiette volantes*.

Bain-marie. — An open saucepan or kettle of almost boiling water, that a smaller vessel can be set in, for cooking and warming, extremely useful for keeping things hot, without effecting any alteration in either their quality or quantity. If you keep broth, soup, or sauce by the fire, it reduces and thickens. This is obviated by the use of the *bain-marie*, in which the water should be hot, but not boiling.

Béchamel. — White sauce, now often used, much commended by Francatelli.

Blanch. — To whiten poultry, vegetables, fruit, etc., by dipping them into boiling water for a short time, and afterwards into cold water, letting them remain there for a while till they are whitened.

Blanquette. — A kind of fricassee much used in French cookery.

Bouilli. — Beef, or other meat, boiled or stewed. In France, the term is applied only to beef boiled, the gravy from which forms stock for soups.

Bouillie — A French dish, something like hasty pudding.

Bouillon. — A thin soup or broth, much used by the French peasantry.

Braise. — To stew meat which has been previously blanched, with fat bacon, until it is tender.

Braisière — A saucepan with raised edges, to hold fire on the top. Indispensable in many made dishes.

Caramel. — Burnt sugar. A little piece of sugar is placed at the bottom of a saucepan, and burned; upon it is poured stock or water, little by little, till the whole is brown. Caramel is used to color meats and give tone to sauces, entremets, etc.

Casserole. — A crust of boiled rice, after having been moulded into the form of a pie, filled with a fricassee of white meat or a purée of game.

Compôte. — A stew, as of fruit, or game, or pigeons, or fruits preserved in jelly.

Consommé. — The name by which rich, clear soup, stock, or gravy is commonly known.

Croquette. — A ball of fried rice, potatoes, or crumbs and mincemeat.

Entrées. — Tasty little side dishes, served with the *first* course.

Entremets. — Small side dishes, served with the *second* course.

Escalopes. — Collops; small, round, thin pieces of tender meat or fish, beaten with a rolling-pin to render them tender.

Foncer. — To put slices of ham, veal, or thin, broad slices of bacon into the bottom of a saucepan.

Galette. — A broad, thin cake, used for dessert.

Gateau. — Properly speaking, a cake; but occasionally used to denote a small pudding or tart.

Glacer. — To glaze or spread a thick and rich sauce or gravy, called glaze upon hot meats or larded poultry. A feather or brush is used to put on the glaze. In confectionery, "to glaze," means to ice fruit and pastry with sugar, which glistens when cold and crisp.

Hors d'Œuvres. — Small dishes, or *assiettes volantes* of sardines, anchovies, and similar relishes, used during the first course.

Maigre. — Soup, broth, or gravy, without meat, commonly eaten in Roman Catholic countries on fast days.

Mayonnaise. — Cold sauce or salad dressing for salmon and lobster. Much patronized for luncheons and cold collations.

Menu. — The bill of fare, always given at large dinners.

Merinque. — A sort of icing, made of whites of eggs and sugar, well beaten; or a light trifle.

Mig'nonnette Pepper. — A very coarse ground or broken pepper, either black or white.

Miroton. — Slices of beef for vinaigrette or ragout or onion stew. The slices are larger than collops.

Paner. — To cover meat, etc., for cooking in the oven, on the gridiron, or frying pan, with very fine bread crumbs.

Piquer. — To lard poultry, game, meats, etc., with strips of fat bacon; should always be done according to the grain of the meat, so that when cut, each slice will contain some of the larding.

Purée. — Vegetables or meat reduced to a smooth pulp, and afterwards mixed with sufficient liquid to make it of the consistency of thick soup.

Ragout. — A stew or hash of various meats, poultry, game, etc.

Remoulade. — Salad dressing.

Rissoles. — Balls of finely minced meat (of different kinds) rolled in flour in the hands, fried in oil till they are a deep brown.

Roux, brown and white. — French thickening.

Salmi. — Ragout of previously roasted game or poultry.

Sauce Piquante. — A sharp sauce, with a predominating flavor of vinegar or lemon.

Sauter. — To dress with sauce in a saucepan, shaking it about continually during the process.

HINTS ON WASHING, ETC.

The following practical directions on washing were furnished by an experienced laundress: —

" *Wash* as often as convenient. Dirty clothes put by for weeks are more difficult to clean the longer they remain dirty; they acquire a permanently bad color, and in damp places are apt to become mildewed and rotten.

" *Remove all stains* as soon as possible; leave nothing long enough to fix itself thoroughly to the cloth; wash out grease, gravy, and fruit stains, etc., before putting anything on one side. Fruit stains yield readily to bleaching powder, — especially if, after being put on, it is moistened with a drop of some acid, as vinegar or lemon; but neither acids nor bleaching powder should be used on colored things. Ink stains should never be put into soapy or soda water or lye, as they directly become iron moulds; but should be instantly wetted with clean water, and may be at once removed by the application of a little salt of lemon or dry oxalic acid moistened, which should be washed out immediately.

" *After making starch*, cover it with a plate until required for use; otherwise it forms a useless skin on the top. To prevent starch sticking to the irons, the addition of a small piece of solid paraffine, as the end of a paraffine candle, will be found more cleanly and efficacious than tallow.

" When water has once been made to boil, the fire may be very much lessened, as but little heat is required to keep it at the boiling point. There is no advantage whatever in making water boil furiously, for it is not in the slightest degree hotter than when merely simmering, as all the extra heat given to boiling water goes off in the steam, without raising the heat in the slightest degree.

" The *shrinking* and *discoloring* of woollen articles may be in great part prevented by care in washing them. They should never be washed in hard water, nor in water softened by soda, nor should they be rubbed with soap. The fibres of wool are covered with little points, all directed one way; as the woollen is rubbed, these become tangled together, and form a kind of thick felt, by which means the article is shrunk and thickened. For the same reason it is not desirable to wring woollen things. Before washing, they should be well brushed and shaken, to get rid of the dust; rain or soft river water should have a strong lather made in it with soap, or if the things are very greasy, oxgall may be added, in the proportion of half a pint to six quarts of water; then boiling water should be added to the lather, to make it as hot as it is possible to bear the hand in, and the dirty woollen should be put in, and dipped and raised repeatedly for several minutes. It should then be squeezed (not wrung) as dry as possible from the dirty, slimy liquor, and the process, if necessary, repeated with some clean lather. If the article is not very dirty, and becomes quite clean in the first washing, the second washing may be in hot water only, without soap; and in either case, a blue-bag should be used in the last water. When gall has been used, a third water is necessary to take off the smell. When the article is finished, it should be squeezed as dry as it can be, and dried as quickly as possible in the open air, if the weather is fine."

If you take flannels out of hot water and hang in a freezing air it will shrink them.

Never use *fresh soap:* the dryer and harder it is the less it will stain and waste, and the longer it will last.

Borax is infinitely better for washing clothes than soda, for it injures nothing, and softens, whitens, and cleanses thoroughly; ½ oz. is sufficient for an ordinary washing. Soda will rot clothes and make them yellow. One heaping tablespoonful of borax in quarter-pound cold starch will greatly enhance its stiffening properties.

Rats may be caught by placing a large pot or barrel with a smooth inside, and the bottom covered with meal, for two nights where they most frequent, the third night half fill with water and cover with meal, and drowned rats or mice will be the result.

Cockroaches may be caught in great numbers by placing a large bowl containing some molasses on the floor; their access should be aided by placing strips of wood from the floor to the edge of the bowl, or by having the bowl situated so they can readily reach the top from the outside.

Iron stains are removable by lemon juice or powdered oxalic acid; the latter is only used on white goods, and must be washed out at once.

Soft soap and salt will remove *mildew stains;* the cloth should be dry and the mixture should be allowed to remain a short time on it, and then washed in good suds and then set out to bleach. May require two operations.

Alcohol will keep ice from forming on windows.

For *boots* and *shoes* exposed to wet, the following composition is recommended: —

"Linseed oil, 1 gill; spirits of turpentine, 1 oz.; beeswax, 1 oz.; Burgundy pitch, ½ oz.: to be melted together, and rubbed into the leather when quite dry, before the fire or in the hot sun." This composition will be found very effectual in preserving the leather from both rain and sea water.

To remove the *smell of onions* from a pan, pot, or knives, scour with fine ashes or earth.

For cleaning *knives* and *forks*, use a raw cut potato and brick dust.

A few slices of raw potato will clarify fat.

Never wash *paint* with soap or sand: clear water and a woollen rag is all that is necessary.

Whiting and water will clean the dirtiest glass.

Do not put carpets on your *closet floors;* oilcloth can be kept cleaner.

Foul air is dirty air that has passed over and over again through the lungs of everybody in the room. If we could see it as we can see the soiled water in a wash-basin, nobody would think of using it twice, or after other persons were through with it. "Pin a newspaper," says Dr. Keen, "across the lower ten or twelve inches of the window-frame; that is, pin it on each side and down to the window sill. Then raise the sash one inch or six, according to the weather." The draught will be upward, and the air will be purified without blowing directly upon the sleeper.

Where the sunshine does not enter, the doctor must.

Never place *glassware* where there is any danger of its being broken.

Fold your *wrapping paper* and wind the string around it.

Keep a bag with three places in it for father's, mother's, and the children's *shoes.*

No dirty *old lumber* should ever be allowed to collect in the house. Old shoes and boots, old dirty woollen clothes, and pieces of carpet, are often kept; these render the air of the house very impure, and consequently unwholesome, are exceedingly apt to become mouldy, harbor vermin, serve as breeding places for the clothes moth, and retain most tenaciously any disease to which they may have been exposed. Sell, give away, or burn them, but as you value your health don't keep them.

Rust may be removed by rubbing the article with sweet oil, let it remain over night, and then polish with powdered *unslacked* lime.

Red pepper pods, or a few pieces of charcoal put into the pot, will prevent the smell arising from boiling cabbage, ham, etc.

HOW TO CLEAN BOTTLES, ETC. — What is the best mode of washing bottles or other implements? Is there any science in it? Yes, there is a great deal of science in it, and I think this a very pertinent question.

Before cleaning anything, the first thing to consider is whether the vial or article you are about to wash is worth the chemical you will have to waste upon it. If not, then throw it away; if otherwise, the chemicals are not wasted. Do not count the labor, as it would be the same even if merely washing with water. On any article use water first, — pure water, or as pure as it runs from the hydrants; and next to that, soap. Water will dissolve out most iodides, nitrates, sulphates, chlorides, etc., with which soap is incompatible, even if they are incorporated with fatty substances, as in ointments. Cheapness is the thing to be desired in your washing paraphernalia.

Shot for washing bottles I *do not* recommend; not so much from fear of lead poisoning, but because there are better methods for the same purpose, and less expensive. Shot that has been thrown into a greasy bottle becomes coated with fat, and is unfit for further use, as it will only dirty the next bottle it is thrown into. The shot itself, when once dirty, is hard to clean, and had better be thrown away. A very handy instrument is the bent wire and paper. With a good steel wire, bent into proper shape and introduced into bottles, we can accomplish wonders. A piece of newspaper moistened and sprinkled with powdered pumice stone will scour out of a bottle all dirt of a resinous character. If the bottle has contained any solutions of iron salts, use hydrochloric acid. A bottle that has contained lime water, or in which lime has deposited, is most readily cleansed by hydrochloric acid.

Nitric acid will best cleanse a vessel that has contained lead solutions, as the other acids form insoluble lead compounds. Carbonate of soda put into fish-oil or cod-liver oil bottles, and allowed to stand a few hours, will cleanse them perfectly. A solution of crude potash is an excellent thing to keep on hand, as it is to be preferred to alcohol, ether, benzine, or chloroform, in cleaning vessels that have contained resins, or dirt of a resinous character; it is also useful in cleaning vessels which have contained Prussian blue

THINGS WORTH KNOWING.

1. That fish may be scaled much easier by dipping into boiling water about a minute.

2. That fish may as well be scaled, if desired, before packing down in salt; though in that case, do not scald them.

3. That salt fish are quickest and best freshened by soaking in sour milk.

4. That milk which is turned or changed may be sweetened, and rendered fit for use again, by stirring in a little soda.

5. That salt will curdle new milk; hence in preparing milk porridge, gravies, etc., the salt should not be added until the dish is prepared.

6. That fresh meat, after beginning to sour, will sweeten if placed out of doors in the cool over night.

7. That clear boiling water will remove tea stains and many fruit stains. Pour the water through the stain, and thus prevent its spreading over the fabric.

8. That ripe tomatoes will remove ink and other stains from white cloth; also from the hands.

9. That boiled starch is much improved by the addition of a little sperm or a little salt, or both, or a little gum arabic dissolved.

10. That a teaspoonful of turpentine boiled with white clothes will aid the whitening process.

11. That beeswax and salt will make rusty flatirons as clean and smooth as glass. Tie a lump of wax in a rag, and keep it for that purpose. When the irons are hot, rub them first with the wax rag, then scour with a paper or cloth sprinkled with salt.

12. That blue ointment and kerosene, mixed in equal proportions, and applied to bedsteads, is an unfailing bedbug remedy; and that a coat of whitewash is ditto for the walls of a log house.

13. That kerosene will soften boots or shoes which have been hardened by water, and render them as pliable as new.

14. That kerosene will make tin teakettles as bright as new. Saturate a woollen rag and rub with it. It will also remove stains from clean varnished furniture.

15. That clean rain water and soda will remove machine grease from washable fabrics.

CARE OF BIRDS.

Birds, like human beings, are liable to contract colds, which, if not attended to at once, may terminate in *asthma* or *gapes*. An even temperature is as essential for birds as for man, and draughts are just as injurious to one as the other.

To Cure a Cold, make a stiff paste of hard-boiled egg and powdered cracker. Rape seed and millet are also used in addition to the regular diet, to good advantage.

For Hoarseness or loss of voice, white rock candy, dissolved in water, may be added to the treatment above mentioned. The paste, however, for this disease, should be seasoned with cayenne pepper.

For Asthma or difficult breathing, when produced by an overloaded stomach, administer plantain and rape seed moistened with water. No other food should be allowed the bird till the cure is effected.

For Gapes, the symptoms of which are a bloated appearance, a continuous opening and closing of the bill, accompanied by panting. *Treatment:* Keep the bird warm; give ripe plantain, canary, and rape seed, in addition to the egg and cracker paste, and every morning a teaspoonful of bread and milk warm, and every other day a piece of plain light cake soaked in sherry wine. Minute pieces of salt pork rolled in cayenne pepper may also be used.

Diarrhœa.—Place a piece of chalk between the bars of the cage, or pulverize and sprinkle on the bottom of the cage with the sand, and drop a rusty nail or piece of iron into the drinking cup.

Costiveness may be relieved with any green stuff, such as chickweed, plantain, lettuce, or with a piece of apple.

For Swollen or Sore Limbs use tincture of arnica diluted, ten drops to a gill of warm water. This is also good for sore feet.

Keep the cages perfectly clean and well supplied with gravel or sand, or sand paper, good seed, and plenty of water.

Give the bird his food and bath at a regular time every day. When mated, the female bird needs a piece of lime, and it should be very old and dry.

When the bird has hatched, don't bother her showing her to visitors; and she should always be fed by the same person when possible.

Wipe the cages with cold water and an old towel. Never scour the wire or use hot water.

Loss of Feathers from the Head. — Use only rape seed, varied occasionally with a small piece of raw carrot. Bathe the spot with sweet oil. If occasioned by his efforts to get out of his cage, set the cage low, where you can speak to him occasionally; when calmed down, bathe the bare place with the diluted tincture of arnica, followed, when inflammation subsides, by a sweet-oil application.

Appetizer. — A little hemp and lots of millet seed will act as a tonic to restore the appetite.

Birds' Food. — Seed-eating birds of the smaller species, such as the Nonpareil, Linnet, Indigo Bobolink, Canary, Paroquet, etc., are fed on canary seed. The Red Bird, Brazilian Cardinal, and Grosbeak require a mixture of padda, hemp, and canary seed.

The soft-bill or insectivorous birds, such as Mocking-birds, Robins, Thrushes, Larks, and Blackbirds, are fed on prepared mocking-bird food.

Parrots. — The usual diet of these birds is cracked corn, padda, hemp, and sunflower seed mixed. They should also have a liberal supply of cracker or stale bread. As a drink they require strong coffee. As parrots never bathe, they may at rare intervals be sprinkled with tepid water by means of a corn brush.

The English and American Goldfinches are to be fed on maw or poppy seed, mixed with hemp and canary.

PRESERVATION OF BOOKS.

Books are not merely means of obtaining information; they may be articles of decoration, if properly cared for, and it is of their outward condition and the methods of their preservation that we shall speak here.

Books should, as much as possible, be protected from the dust, and there is hardly an excuse for not fully covering them, since six cents' worth of glass will prevent the exposure of twenty-five ordinary octavo volumes. As a substitute for glass, dwarf curtains of leather or other material hanging from the shelf above, but not so low as to hide the titles of the books, prevents the collection of dust on their upper ends. In case of curtains, they ought to be slit at intervals of three or four inches to allow easy access to the volumes. But glass doors with locks are the best protection, and the cost need be but slight. Books for adults will not then be the toys for children, nor abused by careless servants, if such are in the house.

The turning down of leaves to mark a finished reading or a particular passage ought never to be allowed. It is very easy to have slips of paper for this purpose, and on the exposed end may be written a reference mark if desired.

Ink spots or writing may be removed by applying spirits of salts diluted with five or six times their bulk of water, which may be washed off in two or three minutes with clear water. A solution of oxalic, citric, or tartaric acid will answer the same purpose, as neither of them will affect the printing.

Iron-mould spots may be removed by first applying a solution of sulphuret of potash, to render the iron soluble, and then one of oxalic acid, which is to be washed off with clean water.

Grease spots may be removed by laying powdered pipe-clay on both sides of the paper and applying an iron as hot as may be without scorching the book. This will also take grease stains from colored leather bindings. Another way is to moisten the spot with ether and treat the paper as above, with a hot iron, placing the paper between sheets of white blotting-paper. When the grease has been extracted, all stains can be removed by moistening them with rectified spirits of wine.

Paper yellowed by age or water stains may be bleached by immersion in a bath of chlorine and subsequent rinsing in clean water.

The weak leaves of old books may be strengthened by moistening them with a solution made in the proportion of one quart of water to one ounce of isinglass and a quarter pound of alum, then separating the leaves by clean sheets of paper and pressing them when partially dried. If the leaves are torn, paste and tracing paper must be used.

GAMES.

"A little nonsense now and then
Is relished by the wisest men."

There are a thousand and one axioms which call our attention to the fact that all labor and no amusement is injurious to mankind. Our chief reason, however, for giving so much space to descriptions of games is the belief that they will afford the means of making home cheerful and attractive, and keep many young men and women from spending their evenings away from their own firesides, and in ways possibly productive of harm.

Many of the games here mentioned will be found interesting and instructive, and will have a tendency to develop and increase the reasoning powers. They will sharpen the wits of the youngsters, lighten the cares of the middle aged, and tickle the fancies of the old people; making the hearthstone bright with peals of light and joyous laughter.

ANAGRAMS.

The inversion or transposition of the letters of a word or sentence to form a new word or phrase is an anagram. This is indeed a literary amusement which will extend the intellect and quicken the thinking powers of all ingenious riddlers who seek to excel in this mental pastime. In past ages it engaged the attention of statesmen and divines, and many wise and witty persons have devoted their leisure hours to this exercise of ingenuity.

The term "anagram," in its proper sense, means the letters of one or several words written backwards; being derived from two Greek words, *ana* (backwards) and *gramma* (letter). Thus the word *live* would form its anagram *evil;* but the term "anagram" is now used in the wider sense in which we explained it. Our young friends must not be discouraged at their first attempts in forming anagrams: their anagrams may have little merit,— crude efforts seldom have much to recommend them; but perseverance, here as elsewhere, will be rewarded. The true merit of an anagram springs from an apt association of ideas, and a close relation between the transposed words and the original from which they are derived. This involves much practice, great thought, and an infinitude of patience, but is productive of real enjoyment.

The father of the Earl of Beaconsfield, Isaac D'Israeli, devoted a chapter in his "Curiosities of Literature" to a consideration of the anagrams which he had met with in his wonderful research. The chapter should be read by all who wish to excel in these literary exercises, and from it we have selected a few of the choice specimens recorded therein:—

"Charles James Stuart — Claims Arthur's seat." "James Stuart — A just master." "An eccentric dame in the reign of Charles I. believed herself to be gifted with the spirit of prophecy; but as her prophecies were usually against the government of the day, she was eventually brought by them into the Court of the High Commission. She based her claim as prophetess upon an anagram she had formed on her name: 'Eleanor Davies — Reveal, O Daniel.' This anagram was imperfect, as it had one *l* too many, and the letter *s* was omitted; but it satisfied her. The bishops reasoned with her out of the Scriptures to no avail, but one of the Deans of Arches vanquished her with her own weapons. He took a pen and hit upon this excellent anagram: 'Dame Eleanor Davies — Never so mad a ladie.'"

The names of celebrated men and women of the present day, and those who have come down to us in the pages of history, offer a wide field for the young riddler.

The following are samples, new and old, of this species of anagram, which we have collected from various sources, in the hope that they may incite our young friends to fresh exertions:—

"Louis Napoleon — Ape no lion, Soul."

"Honor est a Nilo (His honor is from the Nile)." — Horatio Nelson.

"Marie Antoinette — Tear it, men; I atone."

"James Watt — Wait steam" (the J being converted into I).

"Lord Palmerston — So droll, pert man."

"Florence Nightingale — Cling on, feeling heart."

"Alfred Tennyson, poet laureate — Neat sonnet or deep tearful lay."

It will be noticed that several of the examples that we have given are particularly apt, anagrammatically describing some special feature in connection with the person selected for experiment.

The names of flowers, birds, etc., can be treated in like manner and afford much amusement. For instance, who would recognize "The calceolaria" when transformed into "Eat coal, Charlie"; the "Geranium — Ear in mug"; or the "Heliotrope — Hit or elope"? Bird-fanciers would be at a loss to discover "The nightingale" in "High gale in tent," or "The turtle dove" in the words "Eve, let truth do." And if we turn to natural history, fresh illustrations abound: "Cool'd rice" effectually disguises that carnivorous reptile the "Crocodile."

DIAMOND AND WORD PUZZLES OF VARIOUS SHAPES.

These puzzles are formed upon the same general principle as described in "Word Squares." The peculiarity of the different puzzles is disclosed in the names, and we will proceed by giving one example of each.

The *Diamond Puzzle* is arranged by selecting letters or words that may be set forth in the shape of a diamond, thus: —

Puzzle.

1. A letter that is both vowel and consonant.
2. A Jewish tribe.
3. A Trojan woman.
4. A character in "Guy Mannering."
5. A Grecian hero.
6. A novelist and poet.
7. A character in "The Tempest."
8. A character in "Love's Labour 's Lost."
9. Effervescence.
10. A letter of the Greek alphabet.
11. A consonant.

Answer.

W
dAn
heLen
berTram
agamEmnon
WALTERSCOTT
sebaStian
merCade
frOth
eTa
T

The central letters read downwards or horizontally name a great novelist and poet, — Walter Scott.

The following is an example of a *Diagonal Puzzle*: —

Puzzle.

1. My first is a ticket.
2. My second is a voice in music.
3. My third is a water bird.
4. My fourth is an expensive ornament.
5. My last is a sharp instrument, useless to, but often longed for by, boys.

Answer.

LabeL
tEnOr
diVer
jEwEl
RazoR

Read from left to right, diagonally, and *vice versa*, as shown by the capital letters, and discover the names of two Irish writers of rollicking humor — Lever and Lover.

The next example is of an *Oblique Puzzle*: —

Puzzle.

1. Malicious retaliation.
2. A musical term.
3. An ecclesiastical assembly.
4. A Scottish river near Elgin.
5. The pen's close companion.
6. A negative.
7. A personal pronoun.

Answer.

R evenge.
O ctave.
S ynod.
S pey.
I nk.
N o.
I.

The initials form the name of a celebrated composer of music, — Rossini.

CRYPTOGRAPHY.

This word, being derived from the Greek *cryptos*, a secret, and *graphein*, to write, almost explains itself.

Cryptographs are formed by the substitution of one letter for another throughout a sentence, or by using figures, signs, etc., in the place of letters. Cryptography as a science is supposed to enter largely into State diplomacy, secret correspondence being maintained by its means with the various State officials scattered over the globe. In the commercial world it is a fact that such correspondence is transmitted by telegraph with much saving of labor and money and with perfect secrecy, each correspondent possessing a key which enables him to translate into plain words and sentences the otherwise unintelligible jumble of signs. The "agony column" of the daily papers often contains specimens of cryptographic writing, most mysterious to the general reader, but plain to those for whom it is intended. It is, however, as a means of amusement that cryptography here finds a place.

The first requisite is to provide ourselves with a key. The following will serve as an example :—

A.	B.	C.	D.	E.	F.	G.	H.	I.	J	K.	L.	M.	N.
8.	z.	w.	t.	3.	s.	r.	v.	4.	p.	n.	m.	l.	a.
O.	P.	Q.	R.	S.	T.	U.	V.	W.	X.	Y.	Z.		
5.	e.	i.	o.	u.	f.	2.	h.	6.	g.	x.	d.		

Shakespeare's "Seven Ages" will then read thus : —

8mm fv3 65omtu 8 uf8r3,
8at 8mm fv3 l3a 8at 65l3a l3o3mx em8x3ou.
fv3x v8h3 fv34o 3g4fu 8at fv34o 3afo8aw3u,
8at 5a3 l8a 4a v4u f4l3 em8xu l8ax e8ofu,
v4u 8wfu z34ar u3h3a 8r3u.

In the solution of this and kindred puzzles the student should examine very carefully to find out the letters, figures, or signs that most often recur; they will be found to stand for *t*, *s*, and the vowels, and as soon as these letters are discovered the translation is easy. We will vary the key, and still this suggestion will hold good.

A.	B.	C.	D.	E.	F.	G.	H.	I.	K.	L.	M.	N.	O.
e.	k.	w.	m.	t.	b.	c.	o.	a.	s.	r.	f.	s.	l.
P.	R.	S.	T.	U.	V.	W.	Y.						
i.	y.	d.	n.	h.	j.	p	g.						

A few lines from Byron's "Childe Harold" will then read thus : —

Notflysadhieceasnotmtpgflys,
Panokytenoerraswtsdtesmpanowottserrkrllf.
Rehcoascnotwrlhmdepegpanoiregbhrdwlys,
Esmrajascedabteynowlsneas'mslnlfk,
Esmcrlpascasnlmeg.

Below is a love-letter, which requires much deciphering, but which is followed by a translation : —

II.
20 cwt., Half Moon.
Initial walking month.

MOST EXPENSIVE HELPER :

A small obligated beefsteak headcovering the pawnbroker's purchase 6 exclamation timepiece correctly. Myself design taking thee 2 the dried grass place-of-sale house of amusement 2 the ocean testament-myself-the-thigh-shiver-pointed weapons pastime of a village.

With kind Cupid,
Myself cured pork always thine,
MALE CAT DONKEY.

TRANSLATION

Hoverton Crescent,
1st March.

DEAREST ADA :

We must meet at uncle's by 6 o'clock precisely. I intend taking you to the Haymarket Theatre to see William Shakespeare's play of "Hamlet."

With kind love,
I am ever yours,
THOMAS.

CHRONOGRAMS.

A chronogram is a sentence or inscription in which occur words containing, as initial letters or otherwise, letters that represent the Roman numerals. In some chronograms the initial letters only are counted as forming the solution of the puzzle, but in others all the letters contained which may be used as Roman numerals are taken into account. History supplies us with many first-rate chronograms; in fact, it was once the custom to strike medals with chronogrammatic sentences, in which the date of the occasion commemorated was set forth by the initial letters of the superscription.

Queen Elizabeth died in the year 1603, and the following chronogram relating to that event has come down to us : —

"My Day Is Closed In Immortality."

The initial letters of this sentence are $\underset{1}{M} = 1{,}000$; $\underset{2}{D} = 500$; $\underset{3}{I} = 1$; $\underset{4}{C} = 100$; $\underset{5}{I} = 1$; and $\underset{6}{I} = 1$, or, MDCIII = 1603.

Gustavus Adolphus, Sweden's great hero, commemorated one of his victories, obtained in the year 1632, by a medal on which was struck the following chronogrammatic inscription : —

$\underset{3}{C}\ h\ r\ \underset{6}{I}\ s\ t\ \underset{4}{V}\ s\ \ \underset{2}{D}\ \underset{4}{V}\ \underset{5}{X}$; ergo $T\ r\ \underset{6}{I}\ \underset{4}{V}\ \underset{1}{M}\ p\ h\ \underset{4}{V}\ s$. *

In this chronogram all the letters representing the Roman numerals have been brought into use, which, arranged in the order set forth by the figures printed beneath them, read as MDC = 1600; V V V V or 4 × 5 = 20; X = 10; and I I or 1 × 2 = 2: or 1632.

These illustrations afford a fair insight into the construction and design of the chronogram proper. A few illustrations of this riddle in its more modern form now follow : —

Write one thousand down, quite plain,
Then half of two, then add again
Fifty and one's final letter;
You can then do nothing better
Than, after every evening meal,
Walk the distance I reveal.

Answer: M (1,000), I (half of two), L (fifty), E (one's final letter), — MILE.

" After supper walk a mile." —*Old English Proverb.*

To half a dozen add six, and to the result add five hundred. The whole will represent a word signifying clear, lucid, bright, or glowing.

Answer: VI (half a dozen); VI (six); D (five hundred), — VIVID or Vivid.

If from five you take five, you may leave a word denoting contempt or dislike.

Answer: FIVE: V (or 5) taken away leaves FIE, or fie!

One thousand two hundred and nothing and one,
Transposed, give a word expressive of fun.

Answer: M (one thousand); CC (two hundred); O (nothing); I (one), — MCCOI or COMIC.
3 5

A thousand and fifty and one transpose,
'T will produce a fruit in Spain that grows.

Answer: M (a thousand); L (fifty); and ONE: or MLONE transposed, — MELON.
1 3 4 5 2

LOGOGRAMS.

As its name implies, a logogram is a puzzle in which a word is made to undergo several transpositions, by the addition, subtraction, reversion of order, or substitution of a letter or letters.

To Lord Macaulay we are indebted for some of the choicest specimens of this class of word-puzzling. One of his logograms has been selected and is given here, because it so clearly displays all the peculiarities of this class of riddle, and because it is also such a marvel of ingenuity and skill, and at the same time is so happily expressed.

"Cut off my head, how singular I act!
Cut off my tail, and plural I appear;
Cut off my head and tail — most curious fact!
Although my middle 's left, there 's nothing there!
What is my head cut off? A sounding sea!
What is my tail cut off? A flowing river!
Amid their mingling depths I fearless play,
Parent of softest sounds, though mute forever."

The answer is, Cod; and every line reveals a fresh play upon the word. Cut off its head, and it is *od* (odd); singular; its tail, and it is plural, Co. (the abbreviation for Company); cut off its head and tail, and it is O (nothing); the head cut off is a sounding Sea (C); its tail, a flowing river, — Dee (D). Amid their (the sea and the Dee) depths the *Cod* may play, parent of softest *sounds* (the air bladder of the cod, a favorite delicacy to many), yet mute forever.

Charles James Fox, the history of whose early life has been written by Mr. G. O. Trevelyan, is to be credited with the following clever logograph: —

"What is pretty and useful, in various ways,
Though it tempts some poor mortals to shorten their days;
Take one letter from it, and then will appear
What youngsters admire every day in the year;
Take two letters from it, and then, without doubt,
You are what that is, if you don't find it out."

Answer: Glass, Lass, Ass.

The next specimen we give is by William Pitt, first Earl of Chatham: —

"To discover the name that my verse would express,
A letter you 'll first from the alphabet guess;
Which letter by this may be easily known, —
Its shape is the very reverse of your own.
My next, if a fair one too rashly exposes
A beauteous complexion of lilies and roses,
What the beams of the sun will infallibly do
To deaden their lustre and sully their hue.
Add to these, what induces the amorous swain
To persist in his vows, though received with disdain.
These, joined all together, will make up the name
Of a family known in the annals of fame."

Answer: S-tan-hope (Stanhope).

Robert B. Brough, the dramatist, was in early life most sensitive to criticism, and gave vent to his spleen in this somewhat bitter logogram: —

"Cut off my head, and you will quickly see
Something disliked by you and me;
Cut off my tail, and then it is clear
The past of a verb will quickly appear;
Cut off my head and my tail also,
You 'll have a conjunction then, I trow.
Whole, I 'm an insect, not over clean,
Dreaded at picnics in meadows green;
To critics, to publishers, intimate friends,
My name a most delicate piquancy lends;
When they smile in their guile, and hiss as they sing,
And hide under flatteries a venomous sting."

Answer: Wasp, Asp, Was, As.

The following words will be found suitable for use in puzzles of this nature: —

Span. (Snap, spa, asp, pan, nap.)
Price. (Rice, ice, rip, rep.)
Lady. (Lad, day, lay.)
Angel. (Angle, glean, leg, glen, lane, gale, lea)
Degrade. (Grade, dare, dear, ear, are, dad, gear.)
Legate. (Eaglet, eagle, gale, lag, gat, get, let.)
Copper. (Pope, Poe, Po core.)

METAGRAMS.

This riddle is formed by changing the initial letter of a particular word again and again, so as to produce as many words as possible of different meanings. Our first example affords a good illustration of the process to be pursued.

Well known to all as a covering for the head;	Cap.
Change my initial, a doze I mean instead;	Nap.
Once more, and an opening you will see;	Gap.
Exchange again, I 'm found inside a tree;	Sap.
Once more, I mean then to befall;	Hap.
Again, I 'm used by travellers, one and all;	Map.
Again, in this my mother often nursed me;	Lap.
Exchange again, and this my food would be;	Pap.
Again, and a sharp blow you 've spelled;	Rap.
Once more, and a blow that 's hardly seen or felt.	Tap.

The following clever metagram is from the pages of the "Modern Sphinx," a book which contains upwards of a thousand different examples of the various kinds of riddles and puzzles in existence: —

There's a word, you'll agree, commencing with B, That expresses a cool, pleasant shade;	BOWER.
But remove letter B and substitute C, Apprehensively shrinking 't is made;	COWER.
Take away letter C, replace it by D, It will name what 's bestowed on a bride;	DOWER.
Now if D is erased and by G replaced, A Welsh word, meaning crooked, is spied;	GOWER.
Thus far very well, now substitute L, We are going down now, you will say;	LOWER.
Letter L shall be gone, and M be put on, There 's a man cutting grass to make hay;	MOWER.
But when M shall have fled, put P there instead, It will name what is mentioned of steam;	POWER.
Pray just now P erase, put R in its place, There 's a man gliding down with the stream;	ROWER.
But now take R away, put S there, we say That a farmer at work then it names;	SOWER.
If for S you put T, you surely will name A noted place close by the Thames.	TOWER.

The following is a good specimen metagram: —

Of letters four, I do denote
  A man of wisdom great,
But cooks do often me devote
  To share — alas! — a goose's fate;
But change my head, and then, instead,
  Part of a book you 'll find;
And if again I 'm carefully read,
  A youth who walks behind;
Change once again, and then you will
  A furious passion see,
Which reason vainly tries to still,
  Keep far removed from me;
Another change, and you will then
  See I 'm remuneration
Earned by all grades of working men
  Throughout the British nation;
But change my head once more, and then
  A prison I appear,
From which sweet sounds oft issue forth
  That pleasant are to hear.

Answer: SAGE. PAGE. RAGE. WAGE. CAGE.

Below is a list of some words suitable for metagrams, together with the various changes which each word allows: —

Bear, Tear, Lear, Gear, Wear, Hear, Pear, Year, Rear, Fear, Sear, Dear, and Near.
Book, Cook, Hook, Look, Nook, Rook, Took.
Waste, Taste, Paste, Caste, Baste.
Bine, Fine, Kine, Dine, Line, Mine, Nine, Pine, Vine, Wine.
Bound, Found, Hound, Mound, Pound, Round, Sound, Wound.
Cork, Pork, Fork, York.
Dame, Fame, Game, Came, Lame, Name, Same, Tame.
Cake, Lake, Rake, Sake, Take, Wake.
Tent, Rent, Lent, Kent, Dent, Cent, Bent.
Vast, Mast, Last, Fast, Cast, Past.
Heather, Feather, Leather, Weather.
Palter, Falter, Salter, Halter.
Basket, Casket, Gasket.

PARAGRAMS.

The meaning of "paragram" is a play upon words, otherwise a pun, a paragrammatist and a punster being convertible terms. The word "paragram" may further be explained as a word or phrase which admits of a double meaning, the effectiveness of which consists in the incongruity and consequent humor caused by the word or phrase being used in totally different senses to that customarily attributed to it. Punning is only effective when impromptu, and can hardly be classed among the social round of word puzzles; but on the other hand, paragrams may be constructed which bring out the different meaning of the same word, giving rise to the exercise of ingenuity, and at the same time affording fun and amusement. The following illustrations will show in what the peculiarity of paragrams consists, and how far superior as a puzzle paragrams are to mere puns: —

I strengthen the weak, I cross the wide sea,
I frighten the thief, and I grow on a tree.

Answer: BARK.

I am a letter and a word,
  I am a tree and Christian name;
And should you me in pieces cut,
  Yourself and act would be the same.
Weigh this with care, and then no doubt
You 'll find its simple meaning out.

Answer: U. YOU. YEW. HUGH. HEW.

TRANSPOSITIONS.

Transpositions differ from anagrams only in the fact that the letters from the word or words selected are not formed into a sentence or other words. For example: —

A Book and its Author. — Trdhsedstotevlfwinalohrchtiyehocfutoeeeeo by Eascepink tap, — which being interpreted reads, What led to the Discovery of the Source of the Nile, by Captain Speke.

An Author and his Works.

Accdeehiklnrss	Charles Dickens.
Abccehiikllnnosy	Nicholas Nickleby.
Arabbdegurny	Barnaby Rudge.
Acdddeefiiloppry	David Copperfield.
Acceehiikppprstwk	The Pickwick Papers.
Cdehhiilooooprssttuy	The Old Curiosity Shop.

A more interesting form of this puzzle is now shown, in the shape of well-known proverbs changed into other sentences.

A rolling stone gathers no moss.
Strong lion's share almost gone.
Time and tide wait for no man.
I don't admit women are faint.
Birds of a feather flock together.
It rocks, the broad flag of the free.

But as these proverbs are changed into sentences, they come more properly under the heading of anagrams. They are given here, however, as in some circles they will be more familiarly known as transpositions rather than as anagrams.

DEFINITIONS.

The proposition to define "Definitions" becomes in itself almost a play upon words; but we may explain that though "Definitions" cannot properly be classed under riddles or word puzzles, yet they are so much akin to them that they claim a place here, and will be found useful as a means of providing amusement. This game will necessitate the use of a table, paper, and pencil or pen and ink. One of the company proposes a word for definition, and it is for the rest of the company to write down their idea of the same in a terse, epigrammatic, poetic, or humorous manner.

A few specimens will illustrate our meaning. Let us suppose the word *Hypocrite* to have been chosen, and the following definitions of the word to have been given in: the definitions should then be read aloud by some one of the company selected for the purpose.

"He who strives to seem and not to be; to whom reputation is everything, character nothing."

"A social spoon of polished gilt, in whom it is only possible to discern distorted reflections of the truth."

"One who wears virtue's livery for the sake of her wages, without any intention of doing her work."

"One who assumes what he has not; a showman who by a startling outside picture screens the barrenness of the entertainment within."

"Like a sugar-coated pill, he seeks to hide his true character under an artificial coating."

Again, as a contrast, take *Hero* as the selected word to be defined: —

"One whose law is love; whose master, duty; whose armor, courage, faith, and hope; and who seeks not glory."

"A victor over self, — the hardest and the noblest conquest of all, but one for which the world has no laurel wreath."

"A nobleman of nature, who has seized his opportunities and displayed the attributes of his race."

"The true hero is the champion of truth, the servant of right, the ruler of himself, and the sworn foe of all that is ignoble."

"He who for others sacrifices self."

"He who fears nothing but his own disgrace."

"He who is stronger than his fellows, and makes his fellows stronger by his strength."

A Coward.

"One who does both good and evil at the bidding of fear."

"He who puts honor in peril, to take himself out of peril."

"One who has stopped the ear of manliness with the cotton wool of self."

Pleasure.

"The emotion we feel after doing a great and noble action."

"The jollification over night, leaving a headache for the morrow."

"A will-o'-the-wisp, ever pursued but never overtaken."

"A false coin, passed off as happiness."

"The leader of folly."

"The sure accompaniment of wisdom."

Many of the above definitions will be recognized as well-known quotations.

Other subjects may be started, such as *Progress*, *Rivalry*, *Nonsense*, *Nothing*, *Thanks*, *Regards*, *Vanity*, *Ridiculous;* and the game may be varied by combining several of these, and forming sentences in which each word shall have its due place: as, "*Vanity* is a disease which preys upon all the good qualities in the human system, reduces them to an aspect *ridiculous* in the extreme, and precludes all ideas of mental *progress*"; or, "*Nothing* gives *pleasure* in successful *rivalry*, if the victory is not honestly won.

INVERSIONS.

Change of order, a turning backward, is the dictionary meaning of this term, and clearly explains the method by which this simple puzzle is constructed.

Inversions belong to the same genus as the logogram, which has been fully described, but have their own peculiarities, as the following examples will plainly show : —

Two letters which express a superfluity,
Inverted name a famous eastern county.
Answer : XS (Excess), SX (Essex).

Invert a title common in Spain,
A mark of recognition you obtain.
Answer : Don, Nod.

Invert a color, quiet, staid,
A term for poet you have made.
Answer : Drab, Bard.

Invert a sliding box in case or table,
You 'll find a recompense — it is no fable.
Answer : Drawer, Reward.

A portion if 't is backwards read
Will prove to be a snare instead.
Answer : Part, Trap.

HIDDEN WORDS.

This puzzle is very similar in principle to many of the other word puzzles previously described ; but in that it has peculiarities and merits of its own, we give it a place by itself. It is like in many respects to the old-fashioned word puzzle known as "Discoveries" ; indeed, "Hidden Words" is a modification of and an improvement upon "Discoveries." In the older and now almost obsolete puzzle, it was the practice for the riddler to propound some sentence in which certain words might be made by piecing together here and there certain letters or combinations of letters formed in the sentence, and which letters, when duly pieced together, would give the designation of some person or persons, place or places, or other object. The following is an illustration of the puzzle in question, and for the better information of the reader the letters to be discovered have been printed in italics; in the actual puzzle, however, it is to be understood that the letters to be discovered are not to be marked in any manner different from the remainder of the text.

Example : Find the name of a great warrior, and a battle he fought, in the following sentence : —

You are looking quite *well* s*in*ce you came from Bri*g*h*ton ;* no doubt the fresh air and sea-*water* were very beneficia*l* *to you*.

Answer : Wellington, Waterloo.

In the modification of this puzzle which we here treat under the title of "Hidden Words," the practice is to so construct the sentence from which the hidden word is to be picked out that all the letters forming the word shall be found consecutively and in their proper order. Greater care has, consequently, to be exercised by the proposer of the riddle, while at the same time the difficulty of guessing the answer remains sufficient to make the task worth attempting. The few illustrations following will be useful as examples of the nature of the puzzle. The letters out of which the hidden word is composed are printed in italics to make the object of the puzzle clear to all : —

I at once rowe*d over* to the opposite side of the river.

The hidden word is the name of a seaport town in England, a fashionable seaside resort, and a military depot.

Answer : Dover.

Fe*ar no*thing from me : I have no wish to harm you.

Hidden word is the name of a river in Italy

Answer : Arno.

Hu*sh*, *Ann*, *on*ly you need go.

The name of one of the largest and most historically celebrated rivers in the British Isles.

Answer : Shannon.

Is i*t ham*, *es*pecially cooked for me ?

Another large and famous British river.

Answer : Thames.

I thought it was cap*ital*, *y*our rendering of the character of Iago.

The name of a country of Europe.

Answer : Italy.

*Will I am*use the remaining guests ?

A Christian name.

Answer : William.

The puzzle of "Hidden Words" is sometimes described under the names of "Hidden Cities," "Hidden Rivers," "Hidden Poets," "Hidden Countries," Battles, Events, and the like.

NUMBERED CHARADES.

The "numbered charade" is a species of conundrum, simple in its construction, but possessing enough point to rivet the attention of all the company as to its probable meaning. It possesses, too, a distinguishing characteristic over other riddles, in the contagious influence it exercises upon all seeking its solution. The riddler's quick wit, set to work to solve a good charade, may possibly fail in that attempt ; but assuredly the task itself will suggest ideas of words and their arrangement which he may in his turn announce to the social circle, and thus "keep the ball rolling." This accounts for the great favor in which charades are held as a popular source of amusement.

A charade is an enigmatical composition which describes an object; the name of this object should be composed of two or more syllables, each syllable having a separate and different meaning. In announcing the charade, which may be written in prose or verse, it must be divided into my *first* (first syllable); my *second* (second syllable); my *third* (if there are more syllables than two); and my *whole*, which should signify the name of the object of the puzzle. With this explanation we shall present to our readers a selection of examples, old and new.

The following amusing four lines of doggerel verse were composed by Mr. Mark Lemon. They fulfil all the requirements of the charade, and will be appreciated as a slight souvenir of that master of humor who so long edited the pages of *Punch*:

Old Charlie Browne, who a big rogue was reckoned,
Was brought up at my *first* for making my *second*,
He was fined, and because he no money would pay,
Had to work with my *whole* on the Queen's highway.

Answer: Barrow (Bar Row).

The English statesman, George Canning, is responsible for our next.—

Though weak to a proverb my *first* has been reckoned,
The game is so constantly made of my *second*.
Yet to hosts without number my *whole* bade defiance,
And the world stood amazed at the beauteous alliance.

Answer: Waterloo (Water-Loo).

Archbishop Whately thus tersely arranges our next —

My *first* is equality; my *second*, inferiority; my *whole*, superiority.

Answer: Peerless (Peer-Less).

Charles James Fox, amidst all the cares and anxieties surrounding a great Parliamentary leader, found time to indulge his vein of pleasant humor in this fascinating pastime. The following was his composition.—

My *first* is expressive of no disrespect,
But I never call you by it when you are by;
If my *second* you still are resolved to reject,
As dead as my *whole* I shall presently lie.

Answer: Herring (Her-Ring).

The following charades will further explain the great variety of these puzzles, and may in themselves afford amusement, and will be useful as models on which other charades may be formed:—

Safe on my fair one's arm my *first* may rest,
And raise no tumult in a lover's breast.
My *second* does the want of legs supply,
To those that neither creep nor walk nor fly.
My *whole* 's a rival to the fairest toast,
And when it 's most admired, it suffers most.

Answer: Muffin (Muff-Fin).

My *whole* is the very reverse of my *second*.
My *first* for refreshment is used;
And those who have wasted their gifts in my *whole*,
The talents they have, have abused.

Answer: Inaction (Inn-Action).

My *first* the gift of Mother Eve;
My *next* as old as Adam.
Joined, if my meaning you perceive,
Your humble servant, Madam.

Answer: Woman (Woe-Man).

I sent my *second* to my *first*, but many a *whole* passed before I saw him again.

Answer: Season (Sea-Son).

I put up my *second* round my legs, swept up my *first*, and put my feet on my *whole*.

Answer: Hearthrug (Hearth-Rug).

My *first* should be my *second*, but I would not be my *whole*.

Answer: Beardless (Beard-Less).

My *first* monopolizes Dublin's busy highways; my *second* is Love's favorite epithet; my *whole* in drawing-rooms is always found.

Answer: Carpet (Car-Pet).

My *first* I hope you are, my *second* I see you are. and my *whole* I know you are.

Answer: Welcome (Well-Come).

My *whole* is under my *second*, and surrounds my *first*.

Answer: Waistcoat (Waist-Coat).

My *first* gave us early support; my *second* is with virtues endowed; and my *whole* is to be found near a farm-house.

Answer: Milkmaid (Milk-Maid).

LETTER OR FIGURE CHARADES.

In this description of charade a word is selected and so arranged that other words may be formed with the different letters. The same letters may be repeated; but care should be taken that every letter forming the charade word be employed. Thus, the word "telegraph," being chosen, may be arranged in the following manner, and the charade be propounded as follows:—

I am a word of nine letters: [a] my 1, 2, 7 is a Chinese plant; [b] my 5, 6, 7, 1, 2 is a fireside requisite; [c] my 5, 6, 2, 7, 1 signifies vast; [d] my 5, 6, 7, 8, 4 is the name of a luscious fruit; ^{e}my 9, 4, 7, 1 signifies warmth; ^{f}my 8, 4, 7, 6 is the name of a fruit; ^{g}my 1, 4, 7, 6 signifies to rend; ^{h}my 6, 4, 7, 8 must be done with corn previous to gathering it in; ^{i}my 5, 7, 1, 9, 2, 6 is to collect; ^{j}my 8, 2, 4, 3 is to pare; ^{k}my 7, 3, 2 is the name of a malt liquor; ^{l}my 9, 7, 3, 4 means hearty; ^{m}my 7, 8, 4 is an animal; ^{n}my 9, 4, 7, 3 is to cure; ^{o}my 3, 4, 7, 8 is to jump; ^{p}my 3, 4, 5 is the name of a human limb; ^{q}my 2, 4, 3 is the name of a fish; ^{r}my 1, 6, 7, 8 is the name of an article used to catch vermin; ^{s}my 8, 4, 7, 3 is to ring; and ^{t}my *whole* is a marvellous invention.

Answer: ^{a}Tea; ^{b}grate; ^{c}great; ^{d}grape; ^{e}heat; ^{f}pear; ^{g}tear; ^{h}reap; ^{i}gather; ^{j}peel; ^{k}ale; ^{l}hale; ^{m}ape; ^{n}heal; ^{o}leap; ^{p}leg; ^{q}eel; ^{r}trap; ^{s}peal; ^{t}telegraph.

One other example of letter charades is given, in order to show the vast number of words that can be produced from the letters of one single word:—

I am a word of eight letters: ^{a}my 4, 3, 5, 6, 8 is significant of eminence; ^{b}my 7, 5, 6, 8 is tidy; ^{c}my 3, 6, 4, 1 are untidy; ^{d}it is necessary to frequently practise my 5, 6, 8; ^{e}my 7, 5, 6, 3 is not distant; ^{f}my 1, 5, 6, 8 is a place of rest; ^{g}my 1, 5, 3, 4, 2 is the name of a woollen article; ^{h}my 4, 2, 6, 3 is accoutrements; ^{i}my 4, 6, 8, 5 is an entrance; ^{j}my 1, 5, 8 is to fix in position, ^{k}my 1, 2, 3, 5 is dry and withered; ^{l}my 1, 2, 6 is where ^{m}my 8, 6, 3, 1 live, and ^{n}where bad boys are 1, 5, 7, 8; ^{o}we don't like to 1, 2, 5 the man call for the ^{p}3, 2, 7, 8 and ^{q}3, 6, 8, 5, 1; ^{r}my 7, 5, 8 is used by fishers; ^{s}my 8, 5, 7 is a number; ^{t}my 7, 5, 1, 8 is built in spring; ^{u}my 3, 2, 1, 8 is needful; ^{v}my 3, 6, 8 is vermin; ^{w}my 6, 7, 8 is an insect; ^{x}my 7, 6, 4 is a useful animal; ^{y}my 5, 6, 3 is part of the human body; ^{z}my 8, 5, 6, 3, 1 is a sign of sorrow; ^{aa}my 1, 2, 6, 3 is to burn, and ^{bb}my *whole* is an officer of the army.

Answer: ^{a}Great; ^{b}neat; ^{c}rags; ^{d}eat; ^{e}near; ^{f}seat; ^{g}serge; ^{h}gear; ^{i}gate; ^{j}set; ^{k}sere; ^{l}sea; ^{m}tars; ^{n}sent; ^{o}see; ^{p}rent; ^{q}rates; ^{r}net; ^{s}ten; ^{t}nest; ^{u}rest; ^{v}rat; ^{w}ant; ^{x}nag; ^{y}ear; ^{z}tears; ^{aa}sear; ^{bb}SERGEANT.

VERBAL CHARADE.

A verbal charade is a word made up of letters, one of which is contained in each of different specified words. The following example will clearly set forth the peculiarity of this charade. In the example, the letters forming the charade word are printed in italics:—

My first is in la*m*b, but is not in sheep;
My second in sh*a*llow, but is not in deep;
My third is in ra*t*, but not in a mouse;
My fourth is in v*i*lla, but not in a house;
My fifth is in *l*ove, but is not in hate;
My sixth in a *d*oor, but not in a gate;
My seventh 's in pl*a*nt, but not in a tree;
And now my all a Christian name you'll see.

Answer: MATILDA.

Of verbal charades, the above specimen will be sufficient. Puzzles of this nature are evidently easily made, and from the construction of them by using suitably contrasted words as in the above example, considerable fun and amusement may be derived.

ACROSTICS.

An acrostic is a composition in verse, in which the initial letter of each line, taken in order, forms the name of a person, or of some motto which is the subject of the composition. In the expression of good wishes to friends and relatives, on birthdays and other festive occasions, or in the more ardent outpourings addressed to a loved one, the acrostic finds an appropriate place; but in this collection of word puzzles we prefer to deal with that form of acrostic which presents opportunities for the exercise of skill and ingenuity to the riddler. This will be found in the double acrostic, and other forms to be mentioned.

The double acrostic may be written either in prose or verse, the condition being that the initials and finals of the words to be guessed make two names or two words of definite and different meanings.

The prose double acrostic is the more simple form.

When verse is employed, it is usual to convey the sense of the whole in a couplet preceding the description of the syllables, thus.—

'T is murmured in the last adieu,
When looks are sad, and words are few.

1. The pleasure of a lawyer's life,
   In deeds and wills the cause of strife.
2. Fill to the brim my drinking horn
   With this, and drink to Barleycorn.
3. With glass and song until the dawn of day
   The roysterer stays with me, beguiling time away.
4. My fourth and last you 'll find to be
   The title of a nobleman of high degree.

Answer: Farewell. ^{1}FlaW, ^{2}ALE, ^{3}ReveL, ^{4}FarL.

An ingenious riddler has devised the following fantastic conceit upon this form of riddle, in which the letters beginning the lines spell a word, while the letters ending the lines form another word of exactly opposite meaning; and in doing this he has cleverly contrived to make this striking contrast the subject of his composition:—

U nite and untie are the same—so say yoU.
N ot in wedlock, I ween, has this unity beeN;
I n the drama of marriage each wandering *goñ T*
T o a new face would fly—all except you and I;
E ach seeking to alter the *spell* in their scenE.

A few examples of the simple prose Double Acrostics may prove serviceable in initiating our readers into the mysteries of this word puzzle, and to this end the following are selected: —

1. A city of Lombardy. 2. Signifying unfinished. 3. A famous loch in Scotland. 4. An empire of Europe. 5. What unmarried ladies long for. 6. Signifying uncovered.

The initials read downward and the finals upwards will reveal two celebrated poets.

1. MILAN
2. INCOMPLETE
3. LOMOND
4. TURKEY
5. OFFER
6. NAKED

Answer: Milton, Dryden.

1. A writer of a book prophetic. 2. Singular, but not otherwise odd. 3. A joke that does not always end in mirth. 4. A mother-in-law deeply loved by her son's widow. 5. A law hostile to woman's rights. 6. The name of an ancient German emperor and modern king of Greece. 7. A rare old man.

The initials and finals give the name of a scholar of profound learning, and the work by which he is best known.

1. JOEL
2. ONE
3. HOAX
4. NAOMI
5. SALIC
6. OTHO
7. NONAGENARIAN

Answer: Johnson, Lexicon.

ENIGMAS.

The enigma hints the thing it would convey,
In terms quite various, — opposite, some say;
The secret it reveals, but not so clear as day:
For in dark and mazy paths it ever loves to stray.

This jingle of four lines will convey to the reader some idea of the peculiarities of this word puzzle. We may however add that the modern enigma may be based upon a single object, word, or even a letter of the alphabet; and, like the conundrum, may be made to turn on the rare and unusual use of the word employed.

Lord Byron composed this enigma on the letter I: —

"I am not in youth, nor in manhood, nor age,
But in infancy ever am known;
I 'm a stranger alike to the fool and the sage;
And though I 'm distinguished in history's page,
I always am greatest alone.
I am not in earth, nor the sun, nor the moon;
You may search all the sky, — I 'm not there;
In the morning and evening — though not in the noon —
You may plainly perceive me; for like a balloon,
I am midway suspended in air
Though disease may possess me, and sickness and pain,
I 'm never in sorrow nor gloom;
Though in wit and in wisdom I equally reign,
I 'm the heart of all sin, and have long lived in vain,
Yet I ne'er shall be found in the tomb."

The next enigma is attributed to Charles James Fox: —

"Formed long ago, yet made to-day,
And most employed when others sleep;
What few would like to give away,
And fewer still to keep."

Answer: A bed.

To the pen of Germany's celebrated poet, Schiller, we are indebted for the following expressive enigma —

"A bridge weaves its arch with pearls
High over the tranquil sea.
In a moment it unfurls
Its span unbounded, free.
The tallest ship with swelling sail
May pass 'neath its arch with ease;
It carries no burden, 't is too frail,
And when you approach it flees.
With the flood it comes, with the rain it goes,
And what it is made of nobody knows."

Answer: Rainbow.

The remaining miscellaneous enigmas will suffice to show the variations of which the puzzle is capable: —

"A lady gave me a gift she had not,
And I received her gift, which I took not;
She gave it willingly, and yet she would not.
If she give it me once I force not;
If she take it again I grieve not.
Consider what this is, and tell not;
For I am fast sworn — I may not."

The answer to this quaint and humorous enigma is, A Kiss. The last line will be understood by the old adage, "Kiss and never tell"

"In other days, when hope was bright,
You spoke to me of love and light;
But now you tell another tale.
That life is brief and beauty frail;
Away, ye grieve and ye rejoice,
In one unfelt, unfeeling voice."

Answer: Church Bells.

Enough for one, too much for two, and nothing at all for three.

Answer: A Secret.

"Scorned by the meek and humble mind,
And often by the vain possessed;
Heard by the deaf, seen by the blind,
I give the troubled spirit rest."

Answer: Nothing.

ALPHABETICAL PUZZLES.

The "alphabetical puzzle," though simple in its construction, affords an opportunity for the riddler not only to display his ingenuity, but also to quicken his perception of sound. The puzzle consists in the choice of a word, the sound of which, when uttered, shall be comprised in the naming of one or more letters of the alphabet. The word chosen should then be briefly described or defined, the number of letters forming the word stated, together with the number of letters that when uttered give a sound similar to the sound of the chosen word, thus: —

A word denoting a volume of water spelled with three letters, but that can be expressed with one.

Answer: Sea, C.

This simple example will make the above description perfectly clear; and we now give some other examples, in order to set forth the variety that may be introduced into this kind of amusement.

Words containing four letters which can be expressed in two: —

1.	An adjective	*Answer:*	Wise	Y Y.
2.	A prophet	"	Seer	C R.
3.	Repose and comfort	"	Ease	E E.

Words containing five letters which can be expressed in two: —

4.	An exertion of mind or body	*Answer:*	Essay	S A.
5.	Decrepitude	"	Decay	D K.
6.	An English county	"	Essex	S X.
7.	To surpass	"	Excel	X L.
8.	A lady's Christian name	"	Ellen	L N.
9.	A lady's Christian name	"	Katie	K T.
10.	Plural of a species of corn	"	Peas	P P.
11.	To lay forcible hands on	"	Seize	C C.
12.	Requires replenishing	"	Empty	M T.

Words containing five and six letters which can be expressed in three: —

13.	A tax	*Answer:*	Excise	X I I.
14.	A flower	"	Peony	P N E.
15.	A plaintive poem	"	Elegy	L E G.

Words containing six and seven letters which can be expressed in two: —

16.	A superfluity	*Answer:*	Excess	X S.
17.	Akin to capsicum	"	Cayenne	K N.

Words containing six and seven letters which can be expressed in three: —

18.	A likeness	*Answer:*	Effigy	F E G.
19.	A state of being	"	Entity	N T T.
20.	To pardon	"	Excuse	X Q Q.
21.	Dissolution	"	Decease	D C C.

Word containing seven letters which can be expressed in four: —

22.	A malady	*Answer:*	Disease	D D E E.

GUESSING STORIES.

This is a word puzzle entertainment into which the riddler may, if by a judicious display of imagery, description, and humor, he only properly sets about his work, introduce much genuine amusement and fun.

The puzzle is best explained by an illustration, which is given below, and which can be taken as a model on which other "guessing stories" may be constructed: —

I am the child of the night and the child of the day. Some dread me, some hate me, some find me a good companion. I have walked for many a mile, but no one ever heard my footfalls. Sometimes my master sends me on before him; but as he travels as quickly as I do, he sends me back sometimes, and I have to follow in the rear. I have hands and feet, head and shoulders, but no body. It is impossible to estimate my exact height. Nobody has ever looked into my eyes; nobody has ever incurred my anger. I sometimes in my haste run over people, and am sometimes trampled under foot by them. When my master writes, I always hold a pen by his side; and when he shaves, I generally take a razor too. I have travelled a good deal, and am very old. When Adam walked in Eden, I too was there, and when any new member of Parliament goes to the House of Commons, I nearly always accompany him. Robinson Crusoe was disturbed by my approach when I visited him on the island of Juan Fernandez; and on one occasion I was the means of defeating an army. Although I have no eyes, I could not live without light. I am of very active habits, although I have not the will or the ability to move. Tell me my name.

Answer: A Man's Shadow.

MENTAL SCENES.

These are next of kin to "guessing stories." They will, however, be appreciated, as they afford perhaps greater scope for vividly descriptive narrative.

The following specimen of a mental scene, which is sufficiently close to the original to reveal to all lovers of Shakespeare the play upon which it is founded, will serve as an example as to how these scenes may be rendered: —

From camp to camp, throughout the livelong night, nothing is heard but the hum of either army. So stilly is the scene that the opposing sentinels might almost hear each other's secret passwords.

The cocks commence to crow; the armorers, with busy hammers, secure all rivets in the knights' full armor; the clocks do toll and the third hour of drowsy morning name, and all gives note of dreadful preparation. Proud of their numbers, and insolent with pride, one army rises from a night spent in counting chickens which have ne'er been hatched, and throwing dice for rich lands not yet secured. Anon they chide the cripple, tardy-gaited night, which limps so tediously away. They wait the morn, expectant and exulting. The poor wretches whom they have already in imagination condemned, like sacrifices, by their watch fires sit patiently, and inly ruminate the morning's danger. Oh, now behold the royal captain of this seeming ruined band, walking from watch to watch, from tent to tent. He bids them all good morrow with a modest smile, and calls them brothers, friends, and countrymen. Beholding him, with his cheerful semblance and sweet majesty, one and all pluck comfort from his looks. A largess, universal as the sun, his liberal eye doth give to every one, thawing cold fear and infusing his heroic nature into all. The scene is blurred over with bloodshed; but a ray of light reveals this royal captain, victorious against fearful odds, exclaiming, "O God, thy arm was here! and not to us, but to thy arm alone, ascribe we all!"

Answer: Agincourt. *See* Shakespeare's "Henry V."

Should difficulty be found in painting in words a "mental scene" for the company to discover, a capital plan — as the above example will have indicated — is to read a passage from some great writer, such as Shakespeare or Macaulay or Sir Walter Scott or Tennyson or Carlyle, and leave it to the discernment of the audience to give the name of the scene or incident related. The passage should of course be complete in itself, not too long, and proper names of persons and places which might give a definite clew to the subject of the reading should be removed, and abstract terms like "the hero," "the heroine," "the scene of conflict," and so on, used in their stead. Remember, it is useless to select a "scene" so difficult that no one could identify it, or so easy that everybody could discover it.

REBUSES.

Dr. Johnson and succeeding dictionary makers give, as the meaning of the word rebus, "a word represented by a picture"; but we need not go further than its literal translation, "by things," to arrive at a true idea of this enigma. The rebuses with which we are now about to concern ourselves will be formed by a series of objects (things) which, when taken as a whole, will be found to complete the riddle. This is a pastime in which many of our great men have taken delight. Lord Macaulay is to be credited with the following: —

Here 's plenty of water, you 'll all of you say, (c) Sea
And, minus the *h*, a thing used every day, (a) Hay
And here is nice beverage: put them together,—(t) Tea
What is it, with claws but with never a feather? CAT.

First in the path of Duty, (D)
And ranking first in Art, (A)
Foremost in Virtue and in Vice, (V)
Leading all in Immortality, (I)
And foremost in Devotion. (D)
Pore over these with studious care,
A kingly name is hidden there.

Answer: David.

Eleven letters I contain;
And if you now would find the same,
Know that a figment of the brain
Will straightway help you to my name.

My 2, 3, 6 is a human being; my 4, 5, 6 is a snare; my 2, 3, 4 is a contraction of a girl's name; my 6, 7, 8 is a contraction of a boy's name; my 8, 10, 11 is the name of a weight; my 11, 10, 8 implies negation; my 4, 10, 8 the past tense of a verb signifying to acquire; my 2, 3, 8 is a web of ropeyarn; my 1, 6, 11 is a place of entertainment for man and beast; my 2, 1, 6, 8 is the name of an aromatic plant; my 6, 7, 8, 9, 10, 11 is an immense combination of people.

Answer:	1	2	3	4	5	6	7	8	9	10	11
	I	m	a	g	i	n	a	t	i	o	n.

IMAGINATION.

NUMBERS.

To ascertain a Square Number at a Glance. — Every boy knows that a square number is a number produced by the multiplication of any number by itself: thus 7, multiplied by itself, gives 49 as a result; 49 consequently is a square number, 7 being termed the square root from which it springs. In high numbers the extraction of the square root is an affair of time and trouble, and after all the necessary calculations have been made it may perhaps be found that the number is not a square number. This unnecessary trouble may be saved if the following instructions are remembered: Every square number ends with one of the figures 1, 4, 5, 6, or 9, or with two ciphers preceded by one or other of those figures. Again, every square number is either equally divisible by 4, or when divided by 4 will have a remainder of 1; thus as shown above, the square of 7 is 49, which divided by 4 gives us a quotient 12 and 1 over; 64 again is a square number, and it is exactly divisible by 4.

To distinguish Coins by Arithmetical Calculation. — Request some person to place in one of his hands a bronze coin and in the other a silver one, and to let no one know which hand contains either particular coin. This may be ascertained by the following calculation: The calculator should assign an even number, say 4, to the bronze coin, and an odd number, say 7, to the silver coin. The person holding the coins should be requested to multiply the number assigned to the coin held in his right hand by an even number, and that assigned to the coin held in the left hand by an odd number. Instruct that the products of the two calculations be added together, and if the whole sum be even the silver coin will have been placed in the right hand, and the bronze coin in the left. If the result be an odd number, the reverse arrangement will of course have been made.

Think of a Number. — Tell your neighbor to think of any number he likes, but not to tell you what it is. Tell him then to double it; when he has done that, let him add an even number to it, which you yourself must give him; after doing this he must halve the whole, then from what is left take away the number he first thought of. When he shall arrive so far, if his calculations have all been made correctly, you will be able to give him the exact remainder, which will simply be the half of the even number you told him to add to his own.

Properties of Numbers. — By a careful study of these properties, many amusing arithmetical puzzles and numerical combinations may be arrived at, and are advisable to know.

1. Every odd number multiplied by an odd number produces an odd number.

2. Every odd number multiplied by an even number produces an even number.

3. Every even number multiplied by an odd number produces an even number.

4. An even number added to or subtracted from an even number, or an odd number to or from an odd number, produces an even number.

5. An odd number added to or subtracted from an even number produces an odd number.

6. The digits of the "nine times" multiplication table added together make either 9 or 18 (twice 9), thus: —

9 × 1 = 9
9 × 2 = 18 or 8 plus 1 = 9
9 × 3 = 27 or 7 " 2 = 9
9 × 4 = 36 or 6 " 3 = 9
And so on to
9 × 11 = 99 or 9 plus 9 = 18

Then so on again up to 9 times 24, each table making 9, with the exception of 9 times 22 = 198 = 8 + 9 + 1 = 18. Indeed, the digits, added together, of the product of any number multiplied by 9, will be found to be 9 or a multiple thereof.

7. The digits 1 to 9 may be placed to form 362,880 combinations; this number divided by 9 gives 40,320; these figures added together make 9.

8. If two numbers are divisible by any one number, their sum and their difference will also be divisible by the same number.

9. If two numbers divisible by 9 be added together, the sum of the figures will be either 9 or a multiple of 9.

BIRDS, FRUITS, AND FLOWERS ENIGMATICALLY EXPRESSED.

Little difficulty will be experienced in the construction or solution of this simple form of enigma. It will, however, be found to possess a charm all its own, which will add greatly to the mirth and gayety of the social circle. The following examples will let our readers into the whole secret of this pleasant pastime: —

Birds.

What a severe attack of quinsy prohibits you from doing.
Answer: Swallow.

A portion of a whole, and a continued range of hills.
Answer: Part-ridge.

What a coward does in the hour of danger.
Answer: Quail.

Equality, and a state of utter decay.
Answer: Par-rot.

A monarch, and a toiler of the seas.
Answer: King-fisher.

Fruits.

A vowel and a cooking apparatus.
Answer: O-range.

To give way to anxiety and sorrow.
Answer: Pine.

Flowers.

What a good conscience gives to its possessor.
Answer: Heart's-ease.

A vehicle and a people who live under one government.
Answer: Car-nation.

A noted Quaker and a *handy* article of dress.
Answer: Fox-glove.

WORD SQUARES.

This is a form of word puzzle which has only to be known to become widely popular, demanding ingenuity and patience of no common order before it is mastered. On first setting out we will confine ourselves to words of four letters. Each line of words, from left to right and downwards, must form the same word. One example will clearly show our meaning.

1	M	E	A	D
2	E	D	G	E
3	A	G	U	E
4	D	E	E	D
	1	2	3	4

These letters being read from left to right and downwards, the first row and the first column will be found to form the same word; the second row and the second column the same; and so on. This is the basis of the puzzle. It requires some research to select the fitting words when words of four letters only are used, but when words of five letters are employed we are more puzzled; with words of six letters our perplexities increase, and upon proceeding to higher numbers we are almost prompted to be content with what has already been attained. But difficulty is the great charm to the true riddler, who finds the construction of riddles to be "a whetstone of patience," as Camden aptly named it years ago.

In propounding these puzzles, the synonymes only of the different words out of which the puzzle squares are to be formed are to be supplied, and care must be taken in the selection of the words that they are of the same number of letters.

The following illustration will assist to make our meaning clear: —

1. Compensations (amends). 2. A favorite (minion). 3. To assist (enable). 4. To eat sparingly (nibble). 5. A coin (dollar). 6. Sarcasms (sneers).

1	A	M	E	N	D	S
2	M	I	N	I	O	N
3	E	N	A	B	L	E
4	N	I	B	B	L	E
5	D	O	L	L	A	R
6	S	N	E	E	R	S
	1	2	3	4	5	6

The riddler has to puzzle out the answers of the six words, and write down the answers as shown in the accompanying diagram, always being careful to see that the words when written out are the same in the columns and rows of the corresponding numbers. This illustration will completely let our readers into the mysteries of word squares, and we will now give a few specimens selected from a large quantity which have come under our notice.

Four Letters.

(1) A river in England.	I	S	I	S
(2) A portion of our body.	S	I	D	E
(3) A thought.	I	D	E	A
(4) A chair.	S	E	A	T

(1) A very common Christian name.	J	O	H	N
(2) A river in the United States.	O	H	I	O
(3) The noise of a serpent.	H	I	S	S
(4) A portion of the human face.	N	O	S	E

(1) My first has regal powers to sway,	K	I	N	G
(2) Is worshipped as my second, in a way.	I	D	O	L
(3) In harmony my third is sweet and clear;	N	O	T	E
(4) My fourth 'midst hills is ever near.	G	L	E	N

CARD GAMES.

There is no knowing exactly when card-playing first made its appearance, or who introduced it. Long before whist, cribbage, or euchre was heard of, the natives of India and China amused themselves for many a long hour in card-playing. Though probably they did not restrict themselves to any particular rule or method, still the enjoyment they derived from the game was doubtless quite equal to any that we have now. The old tale that has so often been repeated, that whist was invented purposely to entertain, during his moments of sanity, an English sovereign who had lost his reason, may or may not be true. All we really know is that for more than two hundred years our grandmothers and grandfathers have spent many a happy hour at the card table. As far as we are concerned, with cards, almost more than any other amusement, it is utterly useless to play in a half-hearted sort of manner.

Everything for the time should be forgotten but the game, and into that the whole energy must be thrown. As all good players know, triflers are to be dreaded far more than inexperienced players. The latter, by practice, strict attention, the exercise of judgment, observation, and memory, may soon become skilful players, while the former will never willingly be chosen as partners by good whist players. It is said that good old Sir Roger de Coverley sent a messenger round every Christmas time with a pack of cards to all the cottagers on his estate; and if accompanied, as no doubt they were, with something useful and substantial, nothing could have been much more acceptable.

Long Whist. — Among all card games whist is unequalled; and although no more than four players can join in one game, a whole roomful of people may easily play at the same by simply dividing themselves into so many quartettes, a pack of cards being provided for each set of players.

For long whist four players are required, and a complete pack of fifty-two cards. Partners can be chosen as agreed on. The cards are then shuffled by the "elder hand," who is the player to the left of the dealer, the post of dealer being allotted to the drawer of the lowest card; after which they are cut by the "younger hand," who is the player to the right of the dealer. Beginning with his left-hand neighbor, the whole pack is then dealt out to the players one by one, faces downward, until the last one is arrived at, which, though the property of the dealer, is turned up, displaying the trump suit. If dealt properly, every player will hold in his hand thirteen cards, which he is now at liberty to look at and arrange in order, the owner of each hand being in honor bound not to look at any cards but his own.

The object of the game is for each player to either make himself, or assist his partner in making, as many tricks as possible, so that they together may gain ten points, that number being game in long whist.

The player to the left of the dealer first leads a card, which his left-hand opponent follows with a card of the same suit; the next player does the same, until all four cards are upon the table, the trick belonging to the player of the highest card.

Should any one not be able to follow suit, he may either play a card from another suit, or give one of the trump suit, and may possibly, by adopting the latter method, secure the trick for himself and his partner from the hands of their adversaries.

The winner of the trick is entitled to the next lead, the others following him as they did the former leader; and thus the game goes on until the full thirteen tricks are made. The points gained by each side are then noted down, after which another shuffling takes place, and the cards are again distributed, the game thus proceeding until one of the couples has obtained ten tricks, when the game is won.

Another way of scoring points, and one which greatly facilitates business, is that of counting the honors. The four court cards of the trump suit are called honors, and should any one be fortunate enough to have these four cards dealt to him in one hand, or if he and his partner have the cards between them, they can score four to their game. Three honors count for two; but should the honors be equally distributed, — that is, should one set of partners have only two court cards between them, — the other two cards of the same kind must necessarily be in the hands of their opponents, in which case the honors are said to be "easy," and neither side reaps any advantage from them. Each set of partners must win six tricks, constituting "a book," before they may score any to the game.

It is possible, therefore, for a couple of players to gain ten or eleven points during one round, though such luck very rarely occurs. It is a much more common occurrence for five or six deals to be made before the winning of a game.

Although in playing whist the beginner need know nothing more than the ordinary rules of the game to enable him to take a part, nothing but practice will make him a skilful player. It is only by experience he will learn how necessary it is for him to rigidly adhere to the rules of the game. It is important that all who wish to be good whist players should make themselves thoroughly acquainted with the rules of the game, and also learn what mistakes to avoid.

Rules of Long Whist. — The order and value of the cards in whist is as follows: Ace is highest in play; then follow king, queen, knave, ten, nine, eight, seven, six, five, four, three, two (the lowest).

The trump card must be left on the table until the first trick has been won.

Suit must be followed while it lasts.

Revoking is, not following suit when you have suit.

A revoker must give three tricks to his opponent.

When a revoke has been made, the opponents may search all the tricks.

A revoke cannot be claimed after the cards have been cut for the next deal.

The penalty for a revoke takes precedence of all other scores; tricks score next; honors last.

A game consists of ten points (five in short whist). Each trick above six counts one point.

Honors — *i. e.*, ace, king, queen, and knave of trumps — are thus reckoned: —

If a player and his partner, either separately or conjointly, hold —

1st. The four honors, they score four points.

2d. Three of the honors, they score two points.

3d. Two honors only, they do not score. (In short whist, honors do not count.)

Those players who at the commencement of a deal are at the score of nine cannot score honors.

Honors, unless claimed before the trump card of the following deal is turned up, cannot be scored.

To score honors is not sufficient: they must be called at the end of the hand; if so called, they may be scored at any time during the game.

If an erroneous score be proved, such mistake can be corrected prior to the conclusion of the game in which it occurred, and such game is not concluded until the trump card of the following deal has been turned up.

If an erroneous score, affecting the amount of the rubber, be proved, such mistake can be rectified at any time during the rubber.

In cutting, the ace is the lowest card.

In all cases every one must cut from the same pack.

Should a player expose more than one card, he must cut again.

In cutting for partners, two players cutting cards of equal value, unless such cards are the two highest, cut again; should they be the two lowest, a fresh cut is necessary to decide who shall deal.

Three players cutting cards of equal value cut again.

Bystanders should be silent.

The following rules are valuable to beginners: —

Short Rules for First Hand, or Lead. — Lead from your strong suit, and be cautious how you change suits, and keep a commanding card to bring it in again.

Lead through the strong suit and up to the weak, but not in trumps, unless very strong in them.

Lead the highest of a sequence; but if you have a quart or quint to a king, lead the lowest.

Lead a trump if you have four or five or a strong hand, but not if weak.

Having ace, king, and two or three small cards, lead ace and king if weak in trumps, but a small one if strong in them.

If you have the last trump, with some winning cards, and one losing card only, lead the losing card.

Return your partner's lead, not the adversaries', and if you have only three originally, play the best; but you need not return it immediately when you win with the king, queen, or knave, and have only small ones, or when you hold a good sequence, have a strong suit, or have five trumps.

Do not lead from ace queen or ace knave.

Do not lead an ace unless you have a king.

Having only a few small trumps, make them when you can.

If your partner refuses to trump a suit of which he knows you have not the best, lead your best trump.

When you hold all the remaining trumps, play one, and then try to put the lead in your partner's hand.

Remember how many of each suit are out, and what is the best card left in each hand.

Never force your partner if you are weak in trumps, unless you have a renounce or want the odd trick.

When playing for the odd trick, be cautious of trumping out, especially if your partner be likely to trump a suit; make all the tricks you can early

For Second Hand. — With king, queen, and small cards, play a small one when not strong in trumps; but if weak, play the king. With ace, king, queen, or knave only, and a small card, play the small one.

For Third Hand. — With ace and queen, play her Majesty, and if she wins return the ace. In all other cases the third hand should play his best card when his partner has led a low one. It is a safe rule for third hand to play his highest.

For All the Players. — Fail not, when in your power, to make the odd trick.

Attend to the game, and play accordingly.

Retain a high trump as long as you can.

When in doubt, win the trick.

Play the game fairly, keep your temper, and don't talk.

When not able to follow suit, you should discard from your weakest suit; indeed, the fact of your discarding originally from any suit is an intimation to your partner that you are weak in that particular suit. Natural discards may be distinguished from such as are forced by taking into consideration the aspect of the game at the time of the discard.

If the person discarding has been playing a strong game, or leading trumps, you may be sure that the discard was from a weak suit; while, on the other hand, any one discarding who has not shown strength most likely does it to conceal weakness. The best use that can be made of trumps is a matter that is by no means learned all at once. The advantage generally acknowledged to be the greatest in the possession of a hand strong in trumps is to draw the adversaries' trumps for the bringing in of your own or your partner's long suit. At the same time, should you be weak in every suit but trumps, you have no alternative but either always leading trumps or leading from a weak suit. As a general rule, it is only right to lead trumps when strong in them, therefore your partner's lead of trumps should be returned immediately. Still, a player, however strong in trumps, should not use them recklessly; but remembering that they are meant to disarm the opponents, should employ them as much as possible for that purpose. Such advice, we ought to remark, is only serviceable among sound players; should you have an inexperienced partner, the best thing to be done is to make as many tricks as you can, and not attempt to play scientifically.

When you have played all your trumps, do not choose a suit from which your partner threw away when he was not able to follow your trump lead. Of course he is weak in that suit. If he has thrown away more than one suit, play the suit from which he last threw away.

Leading a high card, then a low one from the same suit, indicates weakness, or it may indicate a wish to have trumps led. Trumping second hand at an early stage of the game also indicates weakness.

When you and your partner have all the trumps between you, if you wish to throw the lead into his hand play a small one.

Holding ace, ten, and a small one, your partner leading the nine of the suit, pass it; for if he holds an honor you make two tricks, counting your ace for a certain trick.

With king, queen, or queen and knave, and another, play one of the high cards in all cases where you are second hand. With an average remainder of trumps and good cards, having one certain loser, throw it away at your first opportunity; it may enable your partner to make his second best of the suit. When your partner does not trump a winning card, you may be quite sure that he means you to play trumps.

Should the queen come from your right in a lead with ace or king, ten or another, pass it; this gives you a ten ace, as, if your partner have either ace or king, you make three tricks in the suit.

Some players, however, think it best to cover the queen.

It is bad policy to lead up to queen or knave, the contrary with respect to the ace or king; the same may be said with reference to leading through those several cards.

If your partner leads trumps and you have four high trumps, endeavor to make sure of three rounds in that suit; should his lead, however, be a nine, pass it; you will then have the lead after the third round.

When the lead comes from your right-hand opponent, play your queen, should you hold ace, queen, and ten.

Short Whist. — The principles of this variation of whist are precisely the same as in the more general game, and the only differences are that short whist is only five points instead of ten, and that honors cannot be called at any period of the game. In other respects, honors are reckoned and the game played as in long whist.

Three-handed Whist. — There are two ways of playing this game. In the first, one player takes "dummy" (the hand that would belong to his partner at four-handed whist), and lays it in suits face upwards on the table. The game is ten points, and then proceeds as in long whist, the player who takes "dummy" directing the play of both his own and the exposed hand. Rules, penalties, etc., are the same as in long whist. The second mode of playing is simpler. Each of the three players stands on his own cards. The game is fifteen points; each honor counts one; and all tricks above four count towards game. The fourth hand — that opposite the dealer — is left face downwards on the table, and the elder hand has the option of exchanging his own hand — after he has seen it — for the "miss," as the unseen hand is called. If he declines to change, the younger hand, and lastly the dealer, may take the unseen hand. When the miss has been taken by one of the players, or as sometimes happens, neither care to change, the game proceeds as before.

Railroad Whist, although formerly confined to the travelling community on railroads, is now slowly but surely gaining an *entrée* into our choicest parlors. In playing this game the rules of long whist apply, save that the honors are not counted and there is no limit to the number of points to be made; but when the sitting is ended, the couple having the largest score is declared the winner.

Euchre. — In this game all cards below the seven-spot are left out, except of course the ace. The best card is the jack of trumps (technically called the right bower). The left bower is the jack of the same color as the trump, and is next in value to the right bower. The ace, king, queen, jack, ten, etc., are the most valuable, in the order named. Unless the jack is trumps on the same color as the trump, it is inferior to the king, queen, and ace. The dealer should deal two cards to each player, beginning at the left hand first, and then three cards, making five in all. Having supplied the players he turns up the top card, which is called trumps. Immediately the trump is turned, the first person on the left of the dealer looks at his hand to see whether it is judicious to pass or order it up. If he thinks he can make three tricks, which is called a point, he may order it up; that is, he will request the dealer to take the trump card, unless he is sure of three points in some other suit. The dealer is bound to take the card up when so ordered, and discard his poorest card for it. If the eldest hand is weak, he will pass. This affords the dealer's partner an opportunity to assist or pass as his hand seems to warrant; if he has good cards enough, with the one his partner has turned, to probably make a point, he will assist, and the dealer assumes the card.

If all pass, then the dealer has the option of taking it up or turning it down: that is, if he has good cards enough in his hand with the deck card to make a point, he will take it up; but if he has a better hand in another suit, he may turn the trump card down and allow his opponent to name the suit if he desires to, but if he declines it goes round till some one makes it, or all pass; then a new deal is had by eldest hand (that is, the party on the left of the dealer). The play is opened by the eldest hand who leads what he chooses, and the others are obliged to follow suit if they have it, and the person playing the highest card takes the trick.

For counters, use any cards that will when combined make five or more, such as the deuce and tray or the four and tray.

To be *euchred* is to fail in your undertaking, as if I make the trump or order it up and fail to make my point; in such a case my opponent would count two.

A player is said to go *alone* when he plays without his partner's assistance. A *lone hand* is a hand capable of winning five tricks.

March — taking all the tricks.

Pass — declining to play with or to make the trump.

The game consists of five points.

Five tricks made by one side count two.

Three or four tricks made by one side count one.

In a lone hand five tricks count four.

Euchre with the Joker. — A euchre pack usually contains a blank or fancy card, which has given rise to this amusing game. It is called the "Joker," or "Whiteface," or highest trump card, and ranks above the right bower. If this Joker should happen to be turned for trump, the dealer must turn up the next card to determine the trump suit. In all other particulars the game is played in the same manner as the regular game of euchre.

Two-handed Euchre. — The deal being made, the non-dealer may pass or order up; should he pass, the dealer at his option may pass, or discard and take up the trump, when the game begins by the lead of the non-dealer; but should the dealer think his hand not strong enough to risk a play, he too will pass, when his adversary may pass again or make a trump (which as a general rule should be next in suit). If he pass a second time, the dealer has a right to make a trump or again pass, in which case the cards are to be bunched, and the deal passed to the original non-dealer.

If the dealer takes up the trump and plays the hand, he must win three tricks to make a point; or should he take the five tricks, he makes a "march," which entitles him to score two points. Should he fail to make three tricks, he is euchred and his adversary counts two points. The same rules apply to the party ordering up or making the trump.

In passing or ordering up, much will depend upon the state of the game, and what the player desires to accomplish; he may pass upon a good hand, when he has reason to believe that by so doing he will euchre his adversary should he play the hand. In this case, too, he should have good reason to suppose that his adversary will take up the trump, or else have cards to make the trump himself.

The player, remembering that he has but a single hand to contend against, may play, or even order up, if he has a reasonable hope of making three tricks. If strong enough, lead your strongest trumps first, until you have won two tricks, and then, having a trump left, lead some other card, so that if your adversary takes it you may have a chance to trump the card he leads, and thus make your point. Having won two tricks, and your adversary being without a trump, play for a *march*, by leading trumps or your highest cards.

The deal is considered equal to a point, therefore never pass the deal except to save a euchre.

Having discarded, you have no right to take the card back and discard another, even though you have made a mistake. Your opponent must profit by your mistakes, as well as by your bad play or weak hand.

The rules of the four-handed game apply equally to two-handed euchre.

Three-handed Euchre. — This game, as its name indicates, is played by three persons; and as each one plays for himself, and is therefore opposed by two adversaries, the game requires closer attention and the exercise of more judgment than any of the other euchre games.

This variety of the game of euchre is of course in almost all points identical with the four-handed game; although the object of the players, each being opposed to the other two, becomes greatly modified by circumstances.

In two-handed euchre, the player may stand upon a slight hand, but not so in this game: to stand or order up he must have a good hand, inasmuch as he has two hands combined against him, and should he be euchred, both adversaries count two.

A march counts two or three, and a euchre two or three, to each or only one of the opposing players, as custom varies in different places.

This is an irregular game, and in this as in all irregular games, unless the players are accustomed to play together, they should make arrangements beforehand as to these and other points of the game which are likely to vary.

When the two players opposing the one making the trump are four and euchre him, the one taking two tricks may go out first, or the arrangement may be that the one next the dealer goes out first.

Railroad Euchre with the Joker. — Railroad euchre is played with a pack of thirty-three cards, consisting of a regular euchre pack, and an additional blank card, which is usually called the "joker," or "dummy."

The joker is always a trump, no matter what suit is turned, and will beat the right bower. Railroad euchre differs also from the regular game in the following particulars: —

1. The game is ten points; or counted at the end of the game, and the one having the largest count is the winner.

2. If the player elects to "go alone," he may call for his partner's best card, and discard any in his own hand; but either player of the opposing side may also call for the best card held by his partner, and if the latter succeeds in gaining a euchre, his side is entitled to a score of four points.

3. If the joker is turned up for trump, the dealer sometimes turns up the next card to determine the suit of trump; however, this does not debar him from discarding and taking the joker in hand, provided his side adopts the suit turned up, or the opposing side orders it up.

Some players agree before commencing play that when this card is turned, spades shall be trumps, or that the dealer shall have the right to name the trump. This and other variations may occur in different communities, as the direct outgrowth of the principle which governs all railroad games, which allows everything that will tend to make the game exciting or interesting.

Set-Back Euchre, when playing single-handed or with two, three, or five players, is more interesting than the ordinary game.

The players start at five; points lost are added to the score, and points won reduce the score, the player first reaching zero winning.

High-low and other games can be played in the same way, taking as the starting-point the number of points generally considered game in each.

Cribbage.

O cribbage, best of games for two!
How it delights me, Tom, with you
To play at nights, when frost and snow
Will not allow us out to go!
Methinks I see you now, with Bob,
Score three for *sequence*, one for *nob;*
And when he thinks all danger past,
You win the game with three for *last*.

In cribbage the court cards count as ten each, and with the ten of each suit, are known as "tens." The rest of the pack reckon according to the value of each, the spots counting from 1 to 10, — the ace being lowest.

The game is played with a full pack of fifty-two cards; and the points are reckoned upon a board having sixty holes on either side, with an end hole for making the game. The cribbage board is divided into compartments of five holes each for the convenience of scoring; and the game is made by fifteens, pairs, sequences, flushes, etc., as will be seen presently.

There are various games at cribbage, for two, three, or four players; but the whole theory of the game is contained in the rules and method observed in five-card cribbage for two players, which I shall now proceed to explain.

The players shuffle the cards in the usual manner, and cut for deal. The player cutting the lowest card deals. The lowest card in cutting is always the ace; but in cribbage, if two court cards, or a court card and a ten, are cut, that is a tie, and the players must cut again. The deal determined, the cards are shuffled by the dealer, who then lays them on the table on his opponent's side of the cribbage board, which is usually placed on the table between the players. The non-dealer then cuts the pack into two parts, and with the undermost half the dealer distributes five cards each, beginning with his adversary. The dealer then places the remaining cards on the other heap, and the pack remains undisturbed by either party till the crib cards are discarded. Each player then looks at his hand and throws out two cards, it being imperative that the non-dealer throws first. The elder hand (the non-dealer) then again cuts the cards on the table by taking up any number, not fewer than three, without exposing the faces of any of the cards; the dealer lifts the topmost card of the lot left on the table, the non-dealer replaces the cards he cut, and the dealer puts the top card, face upward, on the whole. This operation, though rather complicated in description, is very simple in practice. The discarded and the exposed cut card (the turn-up) form what is called the *crib*. The number scored in the crib belongs always to the dealer, the deal being taken alternately. If a knave happen to be the "turn-up," the dealer takes "two for his heels." The turn-up is reckoned in making up the score of each player's hand, as well as of the crib.

The game then commences. The elder hand plays a card, — on his own side of the cribbage board, — calling out the value of the card played. Thus, we will suppose the elder hand to hold a king, knave, and a five; and the dealer a seven, knave, and eight; and that a four has been turned up. The non-dealer then plays (say) the knave, and says "Ten"; the dealer replies by playing his knave, and cries "Twenty," and takes two for the pair; his opponent then plays his king, and says "Thirty." This being the nearest point to thirty-one, and the dealer, having no ace in his hand, cries "Go," when his adversary scores one hole on the board. Each player's hand is then counted: the elder scoring four, — two for each fifteen; and the dealer two, for the seven and eight which make fifteen. But if the knave in either hand be of the same suit as the turn-up, the holder of such knave scores "one for his nob." The crib is then taken by the dealer, and the game proceeds as before. Or to explain this more fully. After dealing, laying for crib, and cutting, as explained, the elder hand plays a card, which the other endeavors to pair or fifteen, — the pips on the one card being added to those on the other. Then the non-dealer plays another card, and so on up to thirty-one, or the nearest point to it. For the "go" a single hole is scored, except when exactly thirty-one is made, when two holes are added to the score of the player whose last card makes the required number, when the remaining cards on both sides are thrown up and the hands are counted. After all the cards are played up to thirty-one, the hands are reckoned thus, in every way that it is possible to produce the combination: —

	Points.
For every fifteen, as 7 and 8, 10 and 5, 9 and 6, 8, 3, and 4, etc.	2
For a sequence of three or four cards, as 2, 3, 4, 5	3 or 4
For a flush in hand, — that is, three cards of any one suit	3
For a full flush, when the cards in hand and the turn up are of the same suit . . .	4
For a pair (two of a kind, as two fives, sixes, sevens, etc.)	2
For a pair-royal (three of a sort)	6
For a double pair-royal (four of a kind, as four kings, aces, etc.)	12
Knave of the suit turned up (the nob) . .	1

Sequences always count double when, in the four cards, there are two of a sort. Thus: suppose the hand to consist of a seven, eight, and two nines, the score would be ten: two for the fifteen (7 and 8), and six for the double sequence (7, 8, 9; 7, 8, 9), with two for the pair of nines. Or, again, suppose the hand to consist of a three, a four, and two fives, the score would be, —

3, 4, 5	3 holes	8 holes.
3, 4, 5	3 "	
The pair	2 "	

The non-player at the commencement of the game takes three holes as an equivalent for the crib belonging to the dealer. This "three for non-dealer" may be taken at any part of the game, but it is usual, in order to avoid confusion, to take them at the beginning. The player who arrives first at the end hole wins the game.

Cribbage differs from all other games at cards by the almost numberless varieties of chances it affords. In almost all the books on card games, cribbage is said to be useful to young people in accustoming them to calculate readily. We may perhaps take this with the least possible grain of salt. Let us now explain the

TECHNICAL TERMS USED IN CRIBBAGE. — *Crib.* — The two cards thrown from the hand of each player. These, with the turn-up, form the dealer's crib.

Fifteens. — Every two, three, or more cards which added together make fifteen reckon two holes towards game, whether they may be made in play, hand, or crib. Fifteens may be formed of court cards and fives, tens and fives, nines and sixes, eights and sevens, or by three or four cards together.

Whenever fifteen can be made of two, three, or more cards, in play or hand, the player making the fifteen adds two points to his score.

Pairs. — Two cards of a sort, as two aces, deuces, kings, queens, etc. Pairs are reckoned in both hand and play. Thus, I play a nine, and my opponent another, for which he scores two; but if I hold a third, and play it, I score six for a *pair-royal*, which consists of three cards of like character, as well as scoring two for the pair when I count my own hand.

Double pair-royal. — Four similar cards, as four threes, fours, fives, sixes, or sevens. These are counted for twelve in play or hand; but beyond the seven the double pair-royal cannot be reckoned in play, because four eights exceed thirty-one.

Sequences are made of three or more cards in consecutive order: as one, two, three, four; nine, ten, knave, queen, etc. A double sequence occurs when two of the cards are of the same denomination, as I have already explained. In a hand consisting of four cards, a double sequence counts eight; in a crib of five cards, a full double sequence scores ten: 2, 3, 4, 5, 5,—eight for the double run, and two for the pair. Of course the double sequence can also be made in play. For instance, your adversary plays an ace, and you a five; he a deuce and you a four. He then plays a three, and scores five for the sequence. But if your last card happened to be an ace, a deuce, a five, or a six, you also would make a sequence of five (for the 1, 2, 3, 4, 5 last played); or three for the 2, 3, 4; or five for the 1, 2, 3, 4, 5; or six for the entire run. It is not necessary, you perceive, that the cards of the sequence should be played in consecutive order; but it is imperative that when the sequence occurs in play the holes should be marked as soon as the score is made, otherwise they are lost.

Flush. — A flush in hand consists of all cards of one suit; in crib the turn-up card must also be of the same suit to constitute a flush.

His Nob. — The knave of the turned-up suit. In counting, in hand or crib, it marks one point.

His Heels. — The knave when turned up. It reckons for two holes, but is only once counted.

End Hole. — The last hole on the board, into which the player places his peg when he makes game.

Pegs. — The little brass, wooden, or ivory pieces with which the game is scored on the board.

The Go. — The point nearest thirty-one. If thirty-one exactly be made, the player scores two holes; for the simple "go," one hole: in addition, of course, to any more he may make with his last card.

Last. — The three holes taken by the non-dealer at five-card cribbage.

The Start. — The state of the pack after being cut and before the cards are dealt.

Rules of Five-Card Cribbage. — 1. The players cut for deal, the holder of the lowest card being dealer. The ace is lowest, and all ties cut again. All tenth cards — kings, queens, knaves, and tens — are ties.

2. Faced cards necessitate a new deal, if called for by the non-dealer.

3. Should too many cards be dealt to either, the non-dealer may score two, and demand another deal if the error be detected previous to his taking up his cards; if he do not wish a new deal, the top or last-dealt cards may be withdrawn and packed; when any player has more than the proper number of cards in hand, the opponent may score four, and call a new deal.

[This is seldom enforced, — a new deal following any misdeal.]

4. If a player touch the pack after dealing, till the period of cutting it for the turn-up card, his opponent may score two points.

5. If a player take more than he is entitled to, the other party not only puts him back as many points as are overscored, but likewise takes the same extra number for his own game.

6. Should either player even meddle with his own pegs unnecessarily, the opponent may score two points; and if either take out his front peg, he must place the same back behind the other. If any peg be misplaced by accident, a bystander may replace it, according to the best of his judgment; but the bystander should never otherwise interfere unless requested by the players.

7. If any player neglect to set up what he is entitled to, he loses the point so omitted to be taken, but his adversary cannot add them to his own score.

8. Each player may place his own cards, when the deal is concluded, upon the pack.

9. The cards are to be dealt one by one.

10. The non-dealer, at the commencement of the game, in five-card cribbage, scores three points, called *three for last;* but in six and eight card cribbage this is not to be done.

11. After the score is taken on the board, the pegs must not be replaced, if a mistake be perceived, without the consent of the opponent.

12. Neither player is allowed to touch his adversary's pegs, under penalty of losing his game, except it be to peg him for a wrong score.

13. All cases of dispute must be decided by appeal to the bystanders.

14. Three cards at least must be removed from the pack in cutting for deal or turn-up.

15. When the knave is turned up, "two for his heels" must be taken before a card is played, or the two cannot be scored.

16. The non-dealer discards for the crib first, and a card once laid out cannot be recalled if it be covered.

17. Neither player may touch the crib cards till the hand is played out.

18. The dealer shuffles the cards, and the non-dealer cuts them for "the start." In four-hand cribbage, the left-hand adversary shuffles, and the right-hand adversary cuts.

Three or Four Hand Cribbage. — These games differ only from the preceding in that the players put out but one card each to the crib; and when thirty-one, or as near as can be, has been made, then the next eldest hand leads, and the players go on again in rotation with any remaining cards, till all are played out, before they proceed to show. For three-hand cribbage triangular boards are used.

A sort of three-hand cribbage is sometimes played, wherein one person sits out, not each game, but each deal in rotation. In this the first dealer generally wins.

The rules are the same as those given above.

Six-Card Cribbage. — This varies only from the five-card game in that the two players commence on an equality, no points for "the last" being scored. Each player retains four cards in hand, and all the cards are to be played out, as in three and four hand cribbage, with five cards. At this game it is of advantage to the last player to keep as close as possible, in hope of coming in for fifteen, a sequence, or pair, besides the end hole, or thirty-one.

Eight-Card Cribbage differs from the preceding games only in the fact of larger scores being made with the increased number of cards.

Examples of Hands. — I now give a few of the hands most common, and which the player will discover at a glance, without counting his cards before him.

Any sequence of three cards and a fifteen	count	5
Any sequence of four cards and a fifteen (as seven, eight, nine, and ten)	"	6
Any sequence of six cards	"	6
Any flush of four cards and a fifteen	"	6
Any flush of four cards and a pair	"	6
Two aces, two twos, and a nine	"	6
A seven, eight, nine, ten, and knave	"	7
Three twos and a nine	"	8
Two sixes and two threes	"	8
Two threes and two nines	"	8
Two sixes, a three, and a nine	"	8
A six, seven, eight, and nine	"	8
A six, five, and two sevens	"	8
Any double sequence of three cards and a pair (as knave, queen, and two kings)	"	8
Any sequence of four cards and a flush	"	8
A six, seven, eight, nine, and ten	"	9
Two tenth cards (not a pair) and two fives	"	10
Two nines, a seven, and an eight	"	10
Two sixes, a seven, and an eight	"	10
Three fours and a seven	"	12
Three sixes and a nine	"	12
Three sevens and an eight	"	12
Three eights and a seven	"	12
Three nines and a six	"	12
Three threes and a nine	"	12
Three sixes and a three	"	12
Three sevens and an ace	"	12
Two tens (pair) and two fives	"	12
Two nines and two sixes	"	12
Two eights and two sevens	"	12
Two fives, a four, and a six	"	12
Two fours, a five, and a six	"	12
Two sixes, a four, and a five	"	12
Two eights, a seven, and a nine	"	12
Two sevens, an eight, and a nine	"	12
Three fives and a tenth card	"	14
Four, five, and six of clubs, and a five of hearts turned up (six for the sequences, three for the flush, four for fifteens, and two for the pair of the fives)	"	15
Two nines, a six, seven, and eight	"	16
Two threes, two twos, and an ace	"	16
Any double sequence of five cards, as 1, 1, 2, 2, 3	"	16
Two eights, a seven, and two nines	"	20
Two sevens, two eights, and a nine	"	24
Two sixes, two fives, and a four	"	24
Two sixes, two fours, and a five	"	24
Two fives, two fours, and a six	"	24

Suppose you have a crib composed of —

A three of spades,
Three of clubs,
Three of diamonds,
Nine of any sort,
And three of hearts on the pack.

How many points would it count? Twenty-four. Thus: —

Double pair-royal of threes . . .	counts	12
Three of clubs, three of diamonds, and nine of hearts — fifteen . . .	"	2
Three of spades, three of diamonds, and nine of hearts — fifteen . . .	"	2
Three of hearts, three of diamonds, and nine of hearts — fifteen . . .	"	2
Three of spades, three of clubs, and nine of hearts — fifteen	"	2
Three of spades, three of hearts, and nine of hearts — fifteen	"	2
Three of clubs, three of hearts, and nine of hearts — fifteen	"	2
Total.		24

Many other hands might be given, but these are sufficient; the experienced player sees, immediately he takes his cards in hand, what they will make with the turn-up added.

Remember always that it is better to spoil your hand than to make your opponent's crib. Look well to the state of his game, and be not too ready in making holes in play. Be careful, watchful, and steady; and above all, *keep your temper!*

High, Low, Jack; or All-Fours. — It is useless to inquire into the origin of this game; because, like many other games at cards, its birthplace and paternity are unknown. Its name, however, is derived from the characteristics of the game itself: the four chances or points consisting of *high*, the name given to the best trump; *low*, the designation of the smallest trump played in the round; *jack*, the knave of the trump suit; and *game*.

There are two distinct varieties of all-fours, in one of which the first card played by the non-dealer from his hand is the trump, and in the other the trump is turned up from the pack. The last is known generally as all-fours, — in fact, as blind all-fours. Certain terms are common to both games, the general characteristics being similar.

Terms used in the Game. — *High*, the highest trump out: the holder scores one point.

Low, the lowest trump out: the original holder scores one point, even if it be taken by his adversary.

Jack, the knave of trumps: the holder scores one point, unless it be won by his adversary, in which case the winner scores the point.

Game, the greatest number that, in the tricks gained, can be shown by either party; reckoning for —

Each ace,	4	towards	game.
" king,	3	"	"
" queen,	2	"	"
" knave,	1	"	"
" ten,	10	"	"

The other cards do not count towards game; thus it may happen that a deal may be played without either party having any to score for game, by reason of his holding neither court cards nor tens. In such a case, or in case of equal numbers (ties), the elder hand, the non-dealer, scores the point for game.

Begging is when the elder hand, disliking his cards, uses his privilege and says, "I beg"; in which case, the dealer must either suffer his adversary to score one point, saying, "Take one," or give each three cards more from the pack, and then turn up the next card, the seventh, for trumps. If, however, the trump turned up be of the same suit as the first, the dealer must go on, giving each three cards more, and turning up the seventh, until a change of suit for trump takes place.

Method of Playing All-Fours. — The game is played with a full pack of fifty-two cards, which take rank as at whist, the ace being the highest and the deuce the lowest. Any number of points may be played for; but it is common to state an uneven number, as five, seven, nine, or eleven.

The players cut for deal, the lowest card having the deal. As in whist and other games, the ace is lowest and the king highest; the other cards taking their regular order. Ties cut again. The dealer then gives six cards to each, one at a time, and turns up the thirteenth if there be two players, and the twenty-fifth if there be four. The turn-up is the trump. The non-dealer then looks over his hand, and either holds it for play or begs, as already explained. If the knave turns up it belongs to the dealer, who scores one for it; but in case it is taken, in play, by a higher card, — ace, king, or queen of trumps, — then the point is scored by the winner. The non dealer having decided on his hand (it is not allowed to *beg* more than once, without it be previously agreed to do so), he plays a card of any suit. Then the dealer plays another card to this, and if it is higher he wins the trick, and plays another card; and so on throughout the six tricks. It is not incumbent on the player to head the trick with one of the same suit or a trump. When the whole of the tricks are played out, the points are taken for high, low, jack, or game, as the case may be. Thus one player may score a point for *high* and the other for *low;* the greatest number, counting on the court cards, aces, and tens, in each hand, reckoning for game. The winning the knave, the making the tens, and the taking your adversary's best cards, constitute the science of the game. The hand in which the knave of trumps is eventually found is the one which scores the point for the *jack*. The *high* and the *low* always belong to the original possessor of those trumps.

LAWS OF ALL-FOURS. — 1. A new deal can be demanded, if in dealing an opponent's card is faced, or if the dealer in any way discovers any of his adversary's cards; or if, to either party, too few or too many cards have been dealt. In either case, it is optional with the players to have a new deal, provided no card has been played, but not afterwards.

2. If the dealer exposes any of his own cards, the deal stands good.

3. No player can beg more than once in each hand, except by previous mutual agreement.

4. Each player must trump or follow suit if he can, on penalty of his adversary scoring one point.

5. If either player scores wrongly, the score must be taken down, and the adversary shall either score four points or one, as may have previously been agreed.

6. When a trump is played, it is allowable to ask the adversary if it is either high or low.

7. One card may count all four: for example, the eldest hand holds the knave, and stands his game; the dealer having neither trump, ten, ace, nor court card, it will follow that the knave will be both high, low, jack, and game.

All-fours is played by either two or four players; the same rules applying in this four-handed, equally as in the two-handed game. The deal is taken by each player alternately, the cut for deal taking place at the commencement of each game.

Blind All-Fours. — This is the more generally played game for two persons. In fact, it is the usual tavern game all over the country, and cannot boast any very aristocratic patronage. Each player has six cards, the first one played by the non-dealer being the trump. There is no begging, and the points are usually seven or nine. Although very simple, all-fours is by no means an uninteresting game. At blind all-fours some reject the sixes and sevens, and count all the spots on all the cards for game. The score can be taken on a cribbage board, or by means of two cards taken from the pack.

All-Fives. —This game is played with an entire pack, in the same way as all-fours; but instead of nine or eleven, sixty-one points are played for to constitute the game, which is marked on a cribbage board. For ace of trumps the holder marks four points when he plays it; for king of trumps, three; for queen, two; for knave, one; for the five of trumps, five; and for the ten of trumps, ten. If the knave, ten, or five be taken in play by superior cards, the points belonging to them are scored by the winner. In counting for game, the five of trumps is reckoned as five, and all the other aces, kings, queens, knaves, and tens are counted as in all-fours. A good deal of skill is necessary in order to play this game well; the proficient holding back a superior card to catch the ten or five. Trump after trick is not compulsory unless previously agreed to. The first card played by the non-dealer is the trump. The rest of the rules are the same as in all-fours. It may be played by four persons, either as partners or singly, and is a good, merry sort of game.

Railroad High-Low is the same as regular high-low, except that the low may be caught and counted for winner, and the jack, when caught, counts six, — five for catching and one as the regular count for jack; but if jack is saved, not caught, it only counts one. In this, as in most railroad games, the players count right on, the count being generally as to how much either side is ahead. Some latitude is also taken, as, after two trumps have been turned, they may turn for or name some other trump or bunch them, though bunching wastes time.

Cassino is a pleasant, simple game. It has the advantage of being a game that may be played by two, three, or four persons. But to understand the method of playing, it is necessary to recollect the

TERMS USED IN THE GAME.

Big Cassino, the ten of diamonds, two points.

Little Cassino, the two of spades, reckons for one point.

The Cards, when you have a greater share than your adversary, three points.

The Spades, when you have the majority of that suit, one point.

The Aces, each of which reckons for one point.

Lurched, when your adversary has won the game before you have gained six points.

THE MODE OF PLAYING CASSINO. — The following rules are given by Hoyle, and adopted by all his continuators : —

The dealer and partners are determined by cutting as at whist. The dealer gives four cards, one at a time, to each player ; and either regularly, as he deals, or by one, two, three, or four at a time, lays four more, face upwards, upon the board, and after the first cards are played, four others are to be dealt to each person, until the pack be concluded ; but it is only in the first deal that any cards are to be turned up.

The deal is lost if, in the first round, before any of the cards are turned up on the table, a card is faced by the dealer ; but if a card happens to be faced in the pack before any of the said four be turned up, then the deal must be begun again.

Each person plays one card at a time, with which he may not only take at once every card of the same denomination upon the table, but likewise all that will combine therewith ; as for instance, a ten takes not only every ten, but also nine and ace, eight and deuce, seven and three, six and four, or two fives ; and if he clear the board before the conclusion of the game, he scores a point. Whenever a player cannot pair or combine, he puts down a card.

The number of tricks must not be examined or counted before all the cards are played ; nor may any trick but that last won be looked at, as every mistake must be challenged immediately.

After all the pack is dealt out, the player who obtains the last trick "sweeps" all the cards then remaining unmatched on the table.

It sometimes happens that the points are not set up, and that neither player wins anything in the deal ; but the smaller number is subtracted from the larger, both in cards and points, and if they both prove equal, the game is recommenced, the deal being taken in rotation. When three persons play, the two lowest add their points together, and subtract from the highest ; but if their two numbers added together amount to or exceed that of the third player, then neither scores.

ARCHERY.

ARCHERY is as old as the hills, for the Scriptures tell us that Ishmael and Esau were archers ; and ancient traditions are full of the feats of Paris, Aster, Ulysses, and Arish. The last-named is said to have shot an arrow at evening and it fell 500 miles away on the next noon. This was on the 13th of October, and that day is celebrated among the Persians as the "Feast of the Arrow."

In those days archery was a means of destruction ; but in these days of the "truly good" it is simply cultivated as an elegant, healthy, and enjoyable summer sport for ladies and gentlemen.

The implements for the game are bows, arrows, gloves, quiver, belt, target, and score cards, with merrie lads and lasses thrown in *ad libitum*.

Bows are made from yew, lancewood, and hickory. The strength must be in proportion to that of the archer. An ordinary man will generally *commence* with a fifty-pound bow, and will not cease his efforts till he can draw a seventy-five-pound bow with ease. A youth's or lady's bow should be from twenty-five to forty pounds in strength.

In order to send the arrow straight, it is absolutely necessary that the archer should be able to *draw the bow with ease*. Of course a practical trial will be necessary to enable the novice to determine what weight of pull best suits him, but the adept can make his selection without leaving the shop, — the strength of every bow being tested in this way : it is strung, and balanced at the handle on some fulcrum, and then weights are hung from the exact centre of the string until it is stretched as far as it would be by drawing an arrow to the head, and the number of pounds' weight then suspended determines its power, and this is marked upon the weapon, which may be a twenty-five, a seventy, or one hundred pound bow. It is from five to six feet long, thickest in the middle, which is termed the handle, and tapering towards the ends, which may be tipped with horn, the upper being the longest. The notches for the string in these tips are called "nocks." The outer and flat side of a bow is termed the back, and the rounded inner side the belly. The handle is covered with silk worsted lace, velvet, or leather.

When not in use the bow should be kept in a green baize bag; and if you entertain that feeling towards it which a good workman generally has for his tool, you will polish it up occasionally, by rubbing it first with oil, and then with French polish.

The bow-string should be made of flax or hemp, and the latter is given the preference. The distance between the bow and the string should be about six inches at the widest part.

Arrows should be twenty-seven inches in length for a bow five feet ten inches. The lady's arrow is generally about two feet long. Arrows are made of lancewood, pine, linden, ash, and poplar. An arrow without feathers will not fly true.

The Quiver is a case, generally of green tin, for keeping arrows in.

The Belt is worn round the waist, and carries the arrows in use, a pot of grease, composed of beeswax and suet, and a tassel to wipe dirt off the arrows.

The Bracer is a leather guard for the left arm, buckled on to that part where the string strikes it when loosened; a very necessary protection.

The Shooting-Glove is composed of three finger ends of thin leather, kept in their place by strips branching from a broader part, which is strapped round the right wrist.

A target card is almost invariably carried at archery meetings; the ladies wearing it suspended from the waist, the men from a button-hole. On it the scores of the competitors are marked with pin pricks, the columns being colored in correspondence with the target — a gold hit scoring nine; a red seven; inner white five, black three; and outer white one.

TARGET CARD.

Archer's Name.	Gold.	Red.	Inner White.	Black.	Outer White.	No. of Hits.	Value.
A							
B							
C							
D							
E							
Total hits and Value.							

Targets are of comparatively modern invention. In the palmy days of archery a white mark (the "clout") was fixed in the centre of the butt by a wooden peg, from which the marker measured to the arrow. To split this peg itself was the very perfection of shooting. The modern target is a flat circle of straw covered with painted canvas, the centre a circular patch of gilt, seven inches across, then a circle of red and another of white, each three inches and a half broad, then a circle of black, one inch and a half, and an outer one of white, one inch broad. The target varies in size according to its distance from the archer. At one hundred yards it should be four feet in diameter; at eighty yards three feet; at sixty yards two feet.

The target is fixed on a triangle of wood or iron, so contrived that it may be elevated or depressed, as the shots are more or less remote.

Stringing the Bow. — Hold the handle in your right hand, with the back of the bow towards you. Place the bottom horn against the hollow of the right foot, turning the latter so as to secure it, the left foot being advanced. Place the palm of your left hand upon the upper end of the bow, taking the eye of the string between the finger and thumb, and slide it up towards the notch as you push with the left hand, and pull with the right till the string is in the notch. Make sure that it is firmly there, and not awry, before you let go. Some archers use the left hand to pull at the handle with, and push the top of the bow with the right; it is the same thing.

Unstringing is done in a similar manner. If the weather is cold, warm the bow before bracing it.

If it is a very powerful bow, you may not be able to put it in practice. Then you must use your knee as a fulcrum, placing the bow across it with the lower horn in the ground, and the rounded inner side toward you, and pulling the top down with the left hand, while you nock the string with the right.

Do not keep your bow strung longer than is necessary. When you have shot your turn, unstring it at once, if several minutes are likely to elapse before you will use it again. A bow kept braced too long together is apt after a time to acquire a bend, or, as it is termed, to follow the string; and this detracts from its strength.

THE FIVE POINTS OF ARCHERY.

Ascham's famous five points are, standing, nocking, drawing, holding, and loosing.

Standing. — Present your left side to the target, the face over the left shoulder, head and neck inclined slightly forward; for if you stand too stiffly erect, you will never acquire the "laying of the body in the bow." The feet are to be firmly planted upon the ground, with the weight of the body resting equally on both; the heels six inches apart. Ascham arrives at the correct attitude by the exhaustive process of pointing out all the faults which are most common. "Some shooteth his head out, as though he would bite the mark; another stareth with his eyes, as though they shulde fly out; another wynketh with one eye, and looketh with the other; . . . another holdeth his neck awrye; . . . another maketh a wrinchinge with his back, as though a man pynched him behynde; another cowereth down, as though he would shoot at crowes; another setteth forward his left leg, and draweth backe with heade and shoulders, as though he pouled at a rope."

Nocking. — "To nock well," says Ascham, "is the easiest point of all, and therein is no art, but only constant attention to nock truly, not setting the shaft either too high or too low, but exactly straight across the bow. Inconstant nocking makes a man lose his strength; and besides, if the shaft hand is high and the bow hand low, or the contrary, both the bow is in danger of breaking, and the shaft, if it is small, will start; if great, it will hobble. You must always nock the *cock-feather* upwards; and be sure the string does not slip out of the nock, for then all is in danger of breaking." Be careful before nocking to see that the bow is not reversed, but that you have got the top uppermost; otherwise the colored silk which marks the nocking point will be in the wrong place, and the arrow will not be drawn in the bow's centre. While fixing the arrow, pass the forefinger of the hand holding the bow over it, to keep it steady, and mind not to ruffle the feathers. The position is secured by placing the first and second fingers of the right hand close on either side of the nock, and holding it and the string by about the middle of the first joints.

Drawing. — In nocking, the bow may be held obliquely, to prevent the arrow falling away from it, but it must be raised to the perpendicular as you shoot. Raise your arms steadily, thrusting your left hand forward with your whole strength, while you draw the arrow to your ear with the right, till the pile (or head) of the arrow reaches the knuckle of the bow hand. No matter whether it is for a near or a distant shot, the arrow must be drawn to the pile. Many archers draw to the breast; but that is bad form, giving considerably less power over the bow. There is another fault, which Ascham points out. Sometimes an archer, he says, "draweth his shaft well, untyll within two fingers of the head, and then he stayeth a little, to looke at hys mark, and that done, pouleth it up to the head, and lowseth; which way, though some excellent shooters do use, yet surely it is a faulte, and good men's faults are not to be followed."

After you have once commenced to draw, never look again at your hand or arrow; keep your eye intently fixed upon the gold, to the exclusion of every other object, until the shaft is sped.

Holding. — Bowmen generally draw with three fingers, and the glove is made with three stalls to that intent, but many only use two. Anyhow, the arrow must be held between the ends and the first joints of the first and second fingers. "Holding must not be long," says Ascham, "after the bow is drawn up, for it puts a bow in danger of breaking, and also spoils the shot. It must occupy so little time that it may be perceived better in the mind when it is done, than seen with the eye when doing."

Loosing. — This, says Ascham, "must be performed much in the same manner as holding. so quick and hard, that it may be without any twitches; so soft and gentle, that the shaft fly not as if it was sent from a bow-case. The mean betwixt both, which is perfect loosing, is not so hard to be followed in shooting as it is to be described in teaching. For clean shooting, you must be careful of not hitting anything about you; and remember to hold your hand always the same height on your bow, that you may keep the length truly."

Doubtless this loosing of the arrow is the most difficult motion in shooting, principally in consequence of the necessity of wearing those clumsy finger stalls; if you had a finger and thumb with pinch enough in them to draw the bow alone, the matter would be easy enough. As it is, there is at first a difficulty, a hitch in letting the string slip at the critical moment, which is as great an impediment to making a good shot as a stiff trigger is in a rifle, or a hang-fire with a shot-gun, and this is only to be got over with practice.

The bow arm must be held as firm as a rock at the moment of loosing; for unless the bow is held as in a vise, the flight of the arrow cannot be steady.

Holding, drawing, and loosing, though treated separately, for the purpose of explanation, form one continuous action; indeed, the archer should loose *while drawing.*

LAWN TENNIS.

Description of the Game. — Lawn tennis is played by one player against another, by one against two, or by two on each side, — never more.

The object is to return the ball over a net, hung midway across the whole court, so as to drop within the lines which define the portion on the other side of the net. A ball, it should be stated at the outset, which drops on any of those lines, is held to have fulfilled the latter condition. A ball which touches the net *en passant* is held to have fulfilled the former. In order to start the ball in play, a player must take it in his hand and strike it with his racket, so as to make it pass over the net; this is called serving, and the player who performs this act is called the server. The service, however, is limited by certain conditions: in giving it, the server must stand with one foot outside the base line of one of the half-courts which he has to defend; he must then deliver the service so that the ball shall drop in the space, not directly, but diagonally, opposite to him, on the other side of the net,— a space bounded by the net, the side line, the half-court line, and the service line. He must serve first from his right-hand half-court. The ball served by him must therefore drop within the space bounded by the net and the above-named lines of his opponent's right-hand half-court, or upon any of those lines. These half-courts are commonly called his right and left courts.

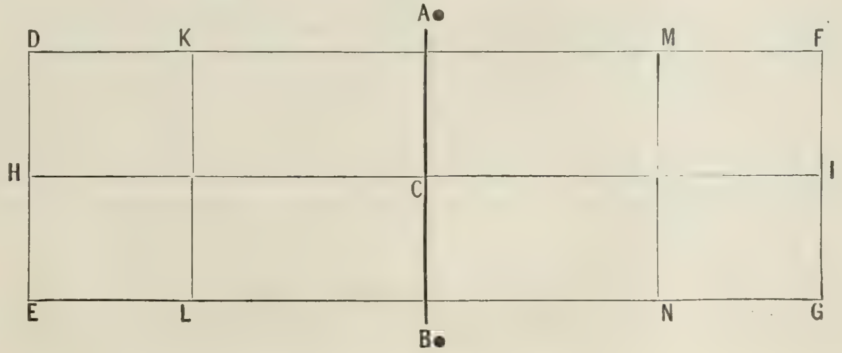
But as there is, in spite of recent legislation, still some advantage attached, or believed to be attached, to the service, it is necessary to decide, before beginning, who shall have this advantage. This may be done by tossing a coin in the air, and crying "heads" or "tails"; but it is more usual for one player to spin a racket, and for the other to call "rough" or "smooth" before it reaches the ground. If it shows that side uppermost which he called, he wins; if the other, he loses. The winner may then either choose to serve first, in which case he leaves the choice of sides to his opponent; or he may leave him the right of first service, and take either side, with whatever advantage there may be, in his opinion, on that side. Playing up-hill, against the wind, or facing the sun, are all considered disadvantages; and the player who chooses the end of the court — or the side, as it is technically called — chooses so as to escape those disadvantages during the first set. At the beginning of the second set, and of every succeeding set of a series of sets, the players change sides, and the server of the last game of one set becomes the striker-out — *i. e.*, the player who receives the service — in the first game of the next.

When the service has been duly delivered according to the conditions described above, it is necessary for the striker-out to return it; that is, to play it back with his racket, so that it will pass over or beyond the net, which it may touch in its passage, and drop anywhere within the lines which define the side or court on the opposite side of the net to himself, or upon any of those lines.

The player who fails to return the ball over the net, or returns it out of court, loses a stroke; and his opponent, whether server or striker-out, is said to win the stroke so lost by the former.

A description, however, of the losses and gains to either player, consequent upon failure or success in returning the ball, will be better given by the laws of the game than by any paraphrase of them; and they are therefore at this point commended to young players' most careful study.

DIAGRAM OF COURT FOR SINGLE-HANDED GAME.



Court and Implements. — 1. The court is 27 feet in width and 78 feet in length. It is divided across the middle by a net, the ends of which are attached to the two posts A and B, which stand 3 feet outside the court on each side. The height of the net is 4 feet at the posts, and 3 feet at the centre. At each end of the court, parallel with the net, and at a distance of 39 feet from it, are drawn the base lines D E and F G, the extremities of which are connected by the side lines D F and E G. Halfway between the side lines, and parallel with them, is drawn the half-court line H C I, dividing the space on each side of the net into two equal parts, called the right and left courts.

On each side of the net, at a distance of 21 feet from it, and parallel with it, are drawn the service lines K L M N.

The Balls. — 2. The size of the balls must not be less than 2½ inches nor more than 2 9-16 inches in diameter, and not less than 1 7-8 ounces nor more than 2 ounces in weight.

3. In matches the decision of the umpire shall be final.

The Game. — 4. The choice of sides and the right of serving during the first game shall be decided by toss; provided that if the winner of the toss chooses the right to serve, the other player shall have the choice of sides, and *vice versa.*

5. The players shall stand on opposite sides of net: the player who first delivers the ball shall be called the *server*, the other the *striker-out.*

6. At the end of the first game, the striker-out shall become server, and the server shall become striker-out, and so on alternately in the subsequent games of the set.

7. The server shall stand with one foot beyond the base line, and the other foot within or upon the base line, and shall deliver the service from the right and left courts alternately, beginning from the right.

8. The ball served must drop within the service line, half-court line, and side line of the court which is diagonally opposite to that from which it was served, or upon any such line.

9. It is a *fault* if the service is delivered from the wrong court, or if the server does not stand as directed in Law 7, or if the ball served drops in the net or beyond the service line, or if it drops out of court or in the wrong court.

10. A fault may not be taken.

11. After a fault, the server shall serve again from the same court from which he served that fault, unless it was a fault because served from the wrong court.

12. A fault may not be claimed after the next service has been delivered.

13. The service may not be *volleyed; i. e.*, taken before it touches the ground.

14. The server shall not serve until the striker-out is ready. If the latter attempts to return the service, he shall be deemed to be ready.

15. A service or fault delivered when the striker-out is not ready shall count for nothing.

16. A ball is *returned* or *in-play*, when it is played back, over the net, before it has touched the ground a second time.

17. It is a good return although the ball touches the net; but if the ball served touches the net, the service, provided it is otherwise good, counts for nothing.

18. The server wins a stroke if the striker-out volleys the service; or if he fails to return the service or ball in-play; or if he returns the service or ball in-play so that it drops outside any of the lines which bound his opponent's court; or if he otherwise loses a stroke, as provided by Law 20.

19. The striker-out wins a stroke if the server serves two consecutive faults; or if he fails to return the ball in-play; or if he returns the ball in-play so that it drops outside any of the lines which bound his opponent's court; or if he otherwise loses a stroke, as provided by Law 20.

20. Either player loses a stroke if the ball in-play touches him or anything he wears or carries, except his racket in the act of striking; or if he touches or strikes the ball in-play with his racket more than once; or if he touches the net or any of its supports while the ball is in-play, or volleys the ball before it has passed the net.

21. On either player winning his first stroke, the score is called fifteen for that player; on either player winning his second stroke, the score is called thirty for that player; on either player winning his third stroke, the score is called forty for that player; and the fourth stroke won by either player is scored game for that player, — except as below: —

If both players have won three strokes, the score is called *deuce;* and next stroke won by either player is scored *advantage* for that player. If the same player wins the next stroke, he wins the *game;* if he loses the next stroke, the score is again called deuce; and so on until either player wins the two strokes immediately following the score of deuce, when the game is scored for that player.

22. The player who first wins six games wins *a set*, except as below —

If both players win five games, the score is called *games-all;* and the next game won by either player is scored *advantage game* for that player. If the same player wins the next game, he wins the set; if he loses the next game, the score is again called games-all; and so on until either player wins the two games immediately following the score of games-all, when he wins the set.

N. B. — Players may agree not to play advantage sets, but to decide the set by one game after arriving at the score of games-all.

23. The players shall change sides at the end of every set; but the umpire, on appeal from either party before the toss for choice, may direct the players to change sides at the end of every game, if in his opinion either side has a distinct advantage, owing to the sun, wind, or any other accidental cause; but if the appeal be made after a match has been begun, the umpire may only direct the players to change sides at the end of every game of the odd and concluding set.

24. When a series of sets are played, the player who was server in the last game of one set shall be striker-out in the first game of the next.

Odds. — 25. A *bisque* is one stroke, which may be claimed by the receiver of the odds at any time during a set, except as below: —

A bisque may not be taken after the service has been delivered. The server may not take a bisque after a fault; but the striker-out may do so.

26. One or more bisques may be given in augmentation or diminution of other odds.

27. *Half fifteen* is one stroke given at the beginning of the second and every subsequent alternate game of a set.

28. *Fifteen* is one stroke given at the beginning of every game of a set.

29. *Half thirty* is one stroke given at the beginning of the first game, two strokes at the beginning of the second game, and so on alternately in all the subsequent games of a set.

30. *Thirty* is two strokes given at the beginning of every game of a set.

31. *Half forty* is two strokes at the beginning of the first game, three strokes at the beginning of the second game, and so on alternately in all the subsequent games of a set.

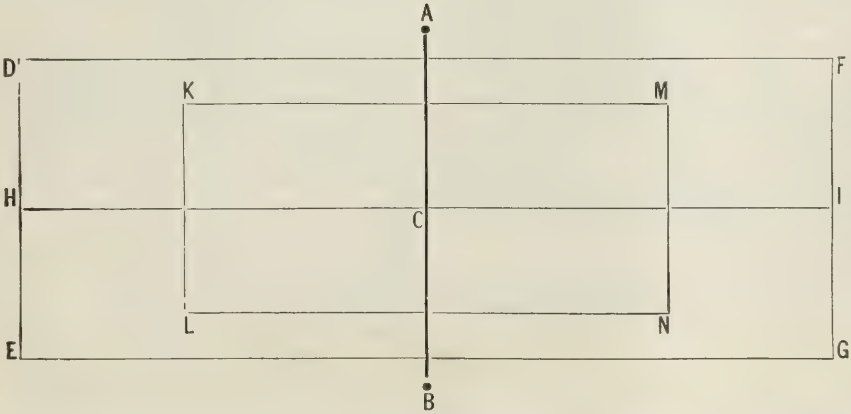
32. *Forty* is three strokes given at the beginning of every game of a set.

33. *Half court:* the players having agreed into which court the giver of the odds shall play, the latter loses a stroke if the ball returned by him drops outside of any of the lines which bound that court.

The Three-handed and Four-handed Games. — 34. The above laws shall apply to the three-handed and four-handed games, except as below: —

35. For the three-handed and four-handed games, the court is 36 feet in width; in the height of net and other respects the court is the same, excepting that within the side lines, at a distance of 4½ feet from them, and parallel with them, are drawn the service side lines K M and L M. The service lines K L and M N on each side of the net are not drawn beyond the points at which it meets the service side lines, as shown in the following

DIAGRAM OF COURT FOR THREE OR FOUR HANDED GAME.



36. In the three-handed game, the single player shall serve in every alternate game.

37. In the four-handed game, the pair who have the right to serve in the first game may decide which partner shall do so, and the opposing pair may decide similarly for the second game. The partner of the player who served in the first game shall serve in the third, and the partner of the player who served in the second game shall serve in the fourth, and so on in the same order in all subsequent games of a set or series of sets.

38. The players shall take the service alternately throughout each game; no player shall receive or return a service delivered to his partner; and the order of service and striking out once arranged shall not be altered, nor shall the striker-out change courts to receive the service, before the end of the set.

39. The ball served must drop within the service line, half-court line, and service side line of the court which is diagonally opposite to that from which it was served, or upon any such line.

40. It is a fault if the ball do not drop as provided in Law 39.

THE GAME OF BADMINTON.

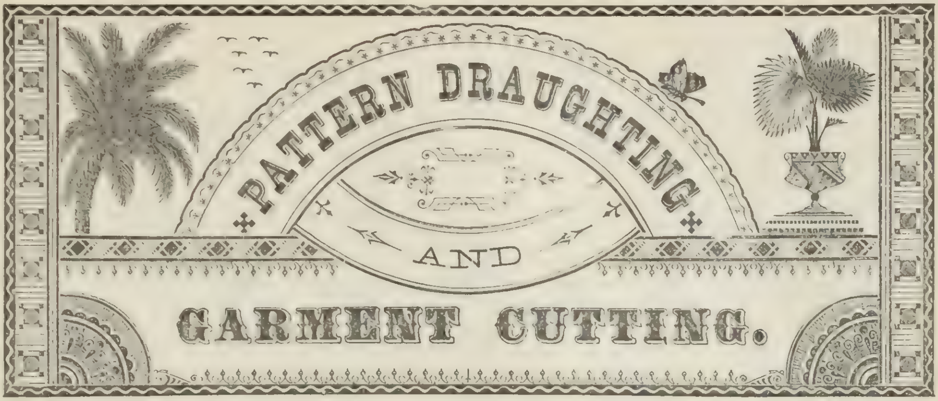
The difference between lawn tennis and badminton is, that while the former is played with a ball, in the latter the shuttlecock is the object of propulsion by the racket. It can be played either in the house — and therein consists one of its advantages — or in the open air. Badminton is played by two, four, six, or even more players, the numbers being equally divided and the sides standing opposite to each other.

The Court, and how to Make it. — The dimensions of the court must be guided in a great measure by the capabilities of the players, though the best size is one 28 feet long by 20 feet broad. The courts should be marked off by means of pegs and strings, and are divided in the following way: At each end of the ground are two courts 10 feet square, while the centre is formed by a piece of neutral ground 8 feet long by 20 feet broad. In India, the ground, after the four courts have been thus marked out by strings and pegs, is carefully nicked out by cutting a small trench about two inches deep and two inches broad; and as soon as the lines of these trenches are nicked out, the trenches are all filled in with whitewash, to give well-defined courts. On each of the outer lines of the neutral ground and in the centre are placed the posts which support the net. The net, which is one foot deep, is suspended at a height of 5½ feet from the ground, firmly held by guy-ropes, as in lawn tennis.

The Materials of the Game. — The rackets are smaller than those used in lawn tennis, the best size being from 24 to 26 inches in length. The shuttlecock is loaded 2½ inches in length, and is the best, at least in windy weather. In many cases the shuttlecock is so made as to be easily contracted by strings interlaced midway in the feathers, after the fashion of the mouths of money bags.

The Game, and how to Play it. — Badminton is played in the same fashion as lawn tennis, with the exception that all the speed produced in the latter by the bounding of the ball is lost in badminton. The shuttlecock is served and returned under the same provisions, except that of course if the shuttlecock falls on the ground it is counted as a miss to the player missing it, and his side.

The neutral ground and the divisions of the respective courts are only observed in the serve or first hit; after that, the partners may stand where they please on their own side of the net. The shuttlecock must be served so that it falls clear over the net without touching the net ropes or posts, or if it falls short of the proper courts into the neutral ground. In all cases, a shuttlecock pitching *on* any of the boundary lines is regarded as a fault, as if it had fallen outside of the boundary lines. In all other respects with regard to the players and the faults, the same rules guide badminton as lawn tennis. In some cases, a shuttlecock falling on the lines in services is termed a fault, and two faults produce "hand-out"; but it is preferable to have a stringent law that a ball falling *on* is regarded as one falling *over* the boundary lines.



PATTERN DRAUGHTING AND GARMENT CUTTING.

THERE is probably no department of mechanics that is so often brought to our attention as the dress-maker's and tailor's, and the expense attending the necessary patronage of these departments constitutes no small part of the family's expenditures, especially where the family is large and the members have the slightest desire to present a neat appearance; therefore if we can reduce the cost of our clothing, we shall either be able to wear better or more stylish appearing clothes for the same money, or else we can put the amount saved to other uses.

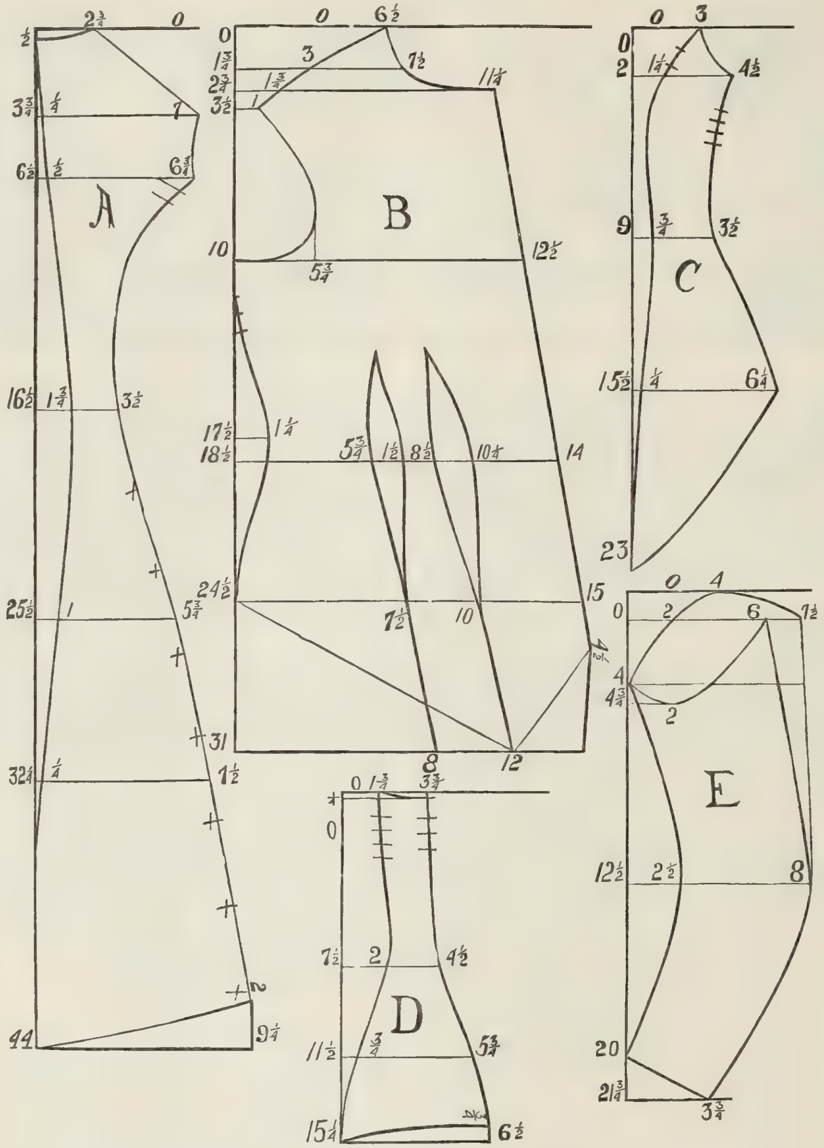
"But how is this possible?" exclaims the anxious matron. The explanation is very simple: instead of buying your clothes ready made or hiring some one to make them, do it yourself.

To do this it is not necessary that you should be either a regular dress-maker or tailor, but simply that you should follow carefully the directions laid down in regard to the several garments described in this article; and by the study which every ambitious woman will give to these principles, other garments may be designed and cut with very little trouble.

A lady who makes her own dresses can make them of course to suit herself, and as much different from those of her neighbors as she pleases. She has also the advantage of knowing that the sewing is as she intended it should be. One of the most essential features in dress-making is a nice-fitting waist or basque, and any woman of ordinary judgment can secure this by observing the following rules.

BASQUE AND SKIRT MEASUREMENT.

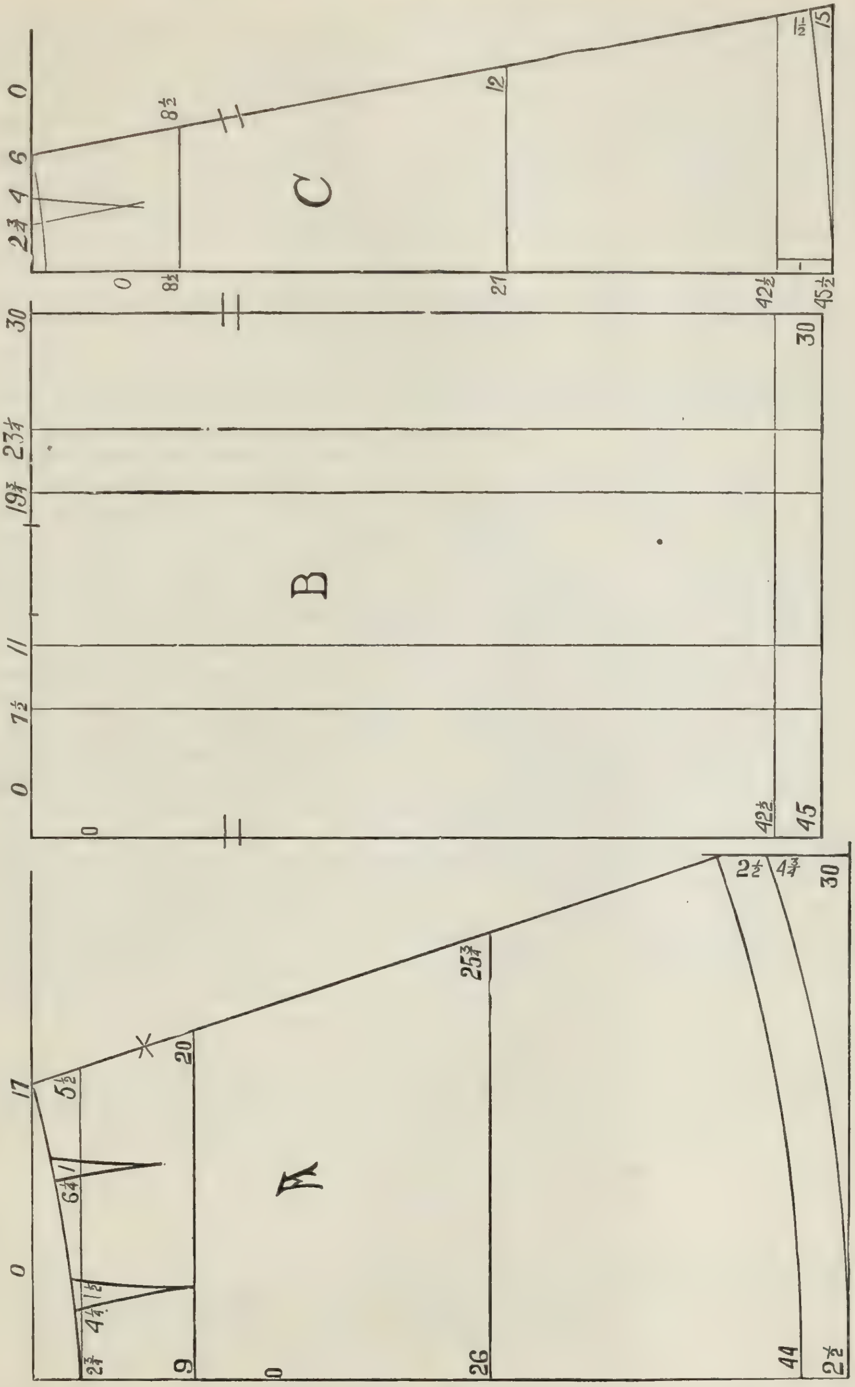
1. Measure width of front above the bust.
2. Measure width of front over the bust.
3. Pin a belt around waist as low down as the hips will allow, and then measure from neck to the bottom of belt, as that will indicate the waist line.
4. Measure width of back from the prominent point of one shoulder to that of the other, and *not* from the seams of the sleeve, as they may not be in the right place in the waist over which you may be measuring.
5. The sleeve measurement is taken from the top of the forearm, where the sleeve is sewed in, to a point as low down as you desire the sleeve to come.
6. Measure around the bust.
7. Measure around the waist.
8. Measure under the arm to bottom of waist.
9. Measure around the neck.



For the skirt the following measures are necessary:—

1. From the hollow of side, above hip, to the floor.
2. From centre of waist line at back, over pannier (if one is to be worn), to the floor.
3. From bottom of waist line in front, to the floor.

The length of skirt is governed by fashion or the wearer's taste. The above measures are to be taken with an inch tape line.


C
0
6
4
2¾
8½
12
15
½
0
8½
21
42½
45½
B
30
23¼
19¾
11
7½
0
0
42½
45
30
A
17
5½
20
25¾
2½
4¾
30
6¼
1
0
4¼
1½
2¾
9
0
26
44
2½

Now that we know the proper and necessary measures to take, the next thing to do is to study the diagrams which are annexed hereto, the first of which is that of a lady's basque, bust measurement 36 inches. The detailed measurement of this garment is as follows:—

1. Width of front above bust, 14½ inches.
2. Width of front over bust, 16½ "
3. Length waist, 16½ "
4. Width of back, 13¼ "
5. Forearm measure, 16½ inches.
6. Bust measure, 36 "
7. Waist measure, 25 "
8. Under arm to waist, 7¾ "
9. Around neck, 13 inches.

The proportionate measures for the skirt accompanying the above are:—

1. Length of skirt at hip, 42 inches.
2. Length of skirt at back, 43½ inches.
3. Length of skirt at front, 41 inches.

Walking-dresses are to be the same length all around if panniers are not used.

After having taken the measures as directed and carefully noted them down, the next step is to draft the pattern. For this purpose take the scale which corresponds with ½ bust measure; for example, if you are making a dress for a lady whose bust measures 36 inches, the scale bearing number 18 is the proper one to use in drafting the pattern. Besides the scale you will require light paper and dark chalk, or *vice versa*, and a ⅂ or cutter's square, and an inch tape. Everything being in readiness, let us draft the back as shown in Diagram A. You will observe that the back is left much longer than the side pieces shown in Diagram C. The object of this is to allow the back to be plaited up to the length of the side pieces, by placing those cross × marks over each other, and thus form a pannier. If, however, a plainer garment is desired, the back may be cut off at bottom to correspond with the length of side pieces. Proceed now and draw a straight line down the length of your paper, then a short line at right angles from first line at the top and bottom. This is called the *base line*, and is marked *o o* in all the diagrams. Now place *end* of scale at the upper left-hand angle of base line, and measure off and mark thus —— the spaces indicated by the following figures on the scale: ½, 3¾, 6½. Now take your tape and place the end of it at ½, and measure down to waist 16½ or whatever the proper measure may be, and from that point to 44. For a plain basque 26 inches is a good length.

Now take the scale again; placing it in the angle as before, mark on the top line the 2¾ space. When a cutter does this he is said to "go out," because he *goes out from the base line;* and when he marks the points *on* the base line, he is said to "mark down." Now place your square against your base line, with its arms across pattern at places first marked, and draw a straight line across. This is called "squaring across." As these terms will be used hereafter in this article, the reader should endeavor to remember their signification. Returning to point 3¾ on base line, go out ¼ and 7, and at 6½ go out ½ and 6¾; at waist length 1¾ and 3½.

N. B.—The length of waist, and all measures below it, are taken with the inch tape.

At 25½ go out 1 and 5¾, at 32¼ go out ¼ and 7½, at bottom 9¼. Apply one half of fourth measure (width of back) at No. 3¾, across to No. 7, and cut accordingly.

DIAGRAM B.

Draw base line *o o*, place scale at angle, and mark down 1¾, 2¾, 3½, and 10; from this point to 17½ use tape, and apply the eighth measure (under arm); and whatever the length is, let it be the hollowest part of the seam, to indicate the waist. Now take your scale and place the end at the top and go down 18½, 24½, and 31; square across at the numbers given, and go out at top 9½; at 1¾, 3 and 7½; at 2¾, 1¾ and 11¼; at 3½, 1; at 10, 5¾ and 12½; at 17½, 1½; at

18½, 1¼ and 5¾. Space for first dart 1½, then 8½ space between darts; for second dart, 1¾, have hollow come to front and then go out 10½ and 14; at 24½ go out 7½, 10, and 15; at 31 go out 8 and 12.

The front of basque at bottom can be left square or cut off to suit taste, as shown in diagram.

The first dart (from front line) at waist should be 2¾ inches, and the top of the dart 3¾ inches distant from said line. Of course, if the figure is large, the nearer the darts are to the front edge the smaller the waist effect. The darts should commence at a point 2½ inches below the line numbered 10 in Diagram B. Also apply one half of first measure 2 inches above line 10, and allow ½ inch more than the measure taken to make up.

DIAGRAM D (Side Piece).

This piece is sewed to front at corresponding marks ≡, which you will observe in the four pieces that go together. Draw base line *o o* and mark down ¼, 7½, 11½, and 15¼. When scale is not long enough to measure, mark as far as it will go and add balance by shoving the scale along.

Square across at numbers marked on base line, and go out at top 1¾ and 3¾; at 7½, 2 and 4½; at 11½, ¾ and 5¾; at 15¼, 6½ and *up* ¾.

DIAGRAM C (Side Body).

Draw base line and place end of scale at top, and mark down 2, 9, 15½, and 23. Square across at these numbers, and go out at top 3; at 2, 1¼ and 4½; at 9, ¾ and 3½; at 15½, ¼ and 6¼. Place basque together in sewing position and measure around the bust and waist. If too large, take in at sides under the arm; and if too small, make wider. Measure neck, and if too wide, take in; alter at shoulder seam by taking it in. If too small, allow at front.

DIAGRAM E (Sleeve).

Draw base line *o o*; place end of tape at top and mark down 4, 4¾, 12½, 20, and 21¾. Square across at these figures and go out at top 4; at 2, 6 and 7½; at 4¾, 2; at 12½, 2½ and 8; at 21¾, 3¾. After the sleeve is drafted, place end of tape measure at point 4, apply measure 5 and cut accordingly. Having now completed draft of basque pattern, next lay it on the lining of waist, all the one way with the lining, and the front of the pattern should not be nearer than ½ inch to selvedge of lining; allow ¾ inch on all seams, until you baste up and try on, as you cannot have a perfect-fitting waist without doing so. When tried on and faults corrected, cut the seams down ¼ inch and overcast them. If the goods are apt to fray, the seams should be ½ inch wide. If outlets are desired, add whatever is necessary.

DIAGRAM OF SKIRT.

The skirt is cut in four pieces: back, front, and two side pieces or gores. As before stated, the scale is not used in drafting the skirt, but the inch tape is. No cuts should be taken out of the front until the front is sewed together, then bring it in to the size of waist; cut a band the proper width and make top of skirt the same size.

To Draft Skirt Front. — Draw base line, place inch tape at top, and mark down 2¾, 9, 26, and 44 (or whatever length is desired); square across at these numbers and go out with the numbers given on diagram.

DIAGRAM B.

Draw base line and go out on top 7½, 11, 19¾, 23¼, and 30; draw a line from each of these points to the bottom, or the length you desire the back of skirt to be. The spaces between 7½ and 11, and 19¾ and 23¼, are for box plaits.

DIAGRAM C.

Draw base line and cut two side gores, one for each side; allow 2½ inches over the length necessary, for a hem, as on Diagram A. It would be almost useless to give any special style of overskirt, or decoration for the same, on account of the variance in tastes and mutability of fashion. The most important matter is to get a skirt that hangs well; after that is secured, little or no trouble will be experienced with the other. One pattern skirt would suffice to cut any number by, altering length and size around waist when necessary.

The English styles adopted for street toilets should find favor with people of small means, because they dispense with elaborate trimmings, and are of such simple designs that they can easily be made at home. Indeed, nothing detracts so much from what is now considered good style as the meaningless and fussy additions put on street costumes with the avowed purpose of making them "more dressy." It is in their *plainness* and their fine *fit* that their beauty lies, and all the outlay of money should be put in the fabric and in the workmanship that gives neatness of finish. The pure wool stuffs worn at present are within the reach of people of small incomes, provided the *cost of the material* is the principal expense, instead of being, as it is too often, scarcely half as much as the price of the trimmings and the dress-maker's bill.

For the cashmere, Jersey cloth, camel's hair, cloth-finished flannel, and lady's cloth suits that are worn in the street and house, alike, trimming is absolutely unnecessary, and, if insisted upon, it consists at the utmost of several rows of inexpensive braid, or a collar, vest, and cuffs of velvet.

Seven yards will be enough for the dress, and if trimming is desired, there should be added a half or three fourths of a yard of velvet of the same shade for the turned-over collar and square cuffs, or the narrow vest.

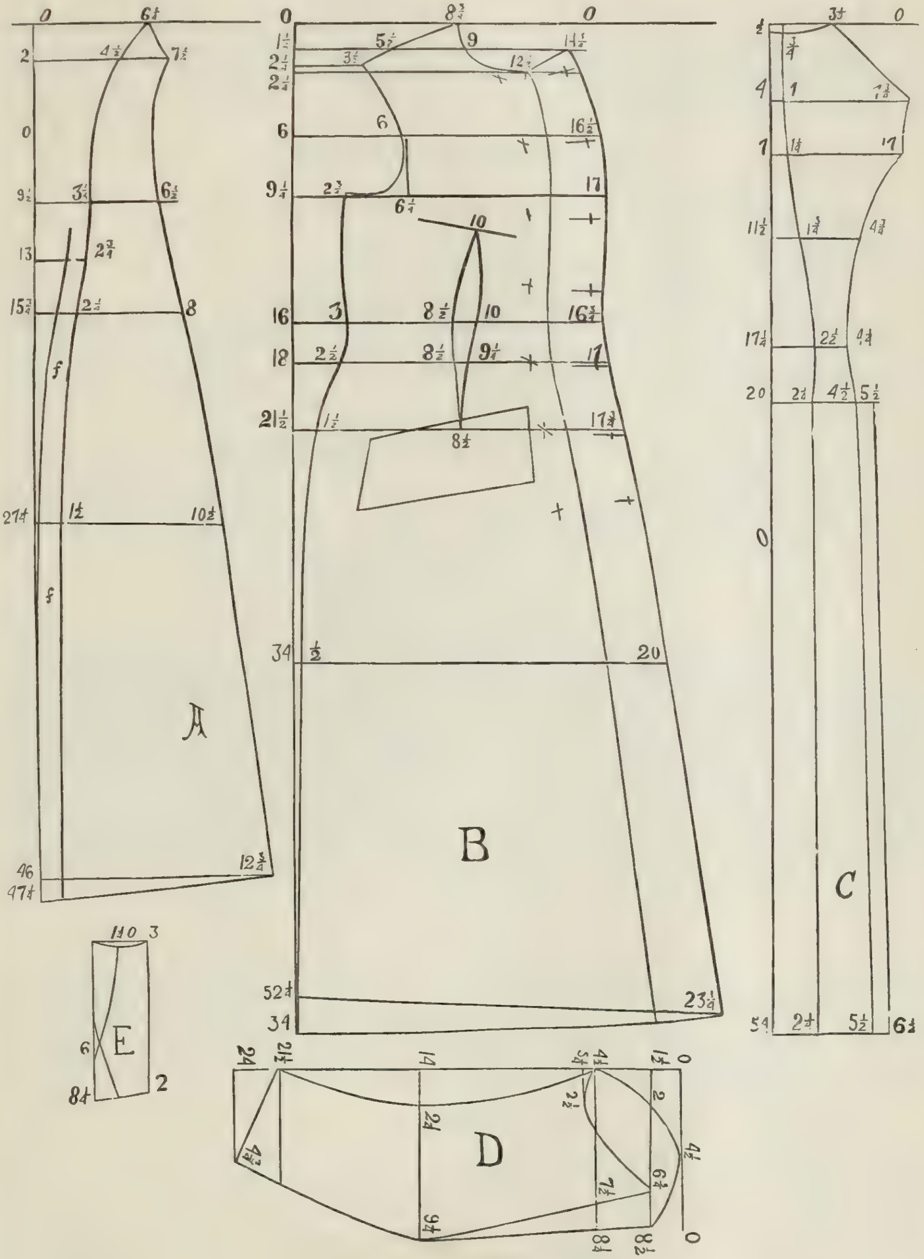
The basque should be fitted very high about the neck, short on the shoulders, with low darts. The back has a short side form beginning in the armhole on each side, and the middle forms at the back are wide at the waist line. Flatly pressed postilion pleats may be added in the middle forms if the figure requires fulness, as this gives a more finished and dressy appearance than closing the seams their whole length plain over the tornure. The latter plan is, however, very much in favor with stout ladies, and is in keeping with the Jersey fashions, and looks particularly well when there is a panier sash drapery that hides the plain edges of the basque.

The inexperienced dress-maker is warned against letting these simply-shaped basques have an appearance of being tight or snugly fitted. Those made by French modistes and London tailors are "clear cut," following every outline of the figure, yet are evidently loose and easy in every part, without compressing the figure in the least.

Sleeves are now made very close to the arm, with the front half much longer than that under the arm, and this makes the armhole large and high, giving freedom and comfort. A cluster of gathers at the elbow is absolutely necessary to give the proper roundness there, and join the full front to the plainer under-arm gore.

The skirt of such a dress is now most often made over a closely gored foundation skirt of alpaca, cotton satine, farmer's satin, or of inexpensive silk; the silk foundation is, however, losing favor because it is usually of a poor quality that is not nearly so durable as the outside fabric. This skirt must be covered with cashmere to the depth of a fourth of a yard, and it may have a narrow pleating set on it also, but this is not necessary.

The skirt breadths of cashmere are attached to this skirt about an eighth of a yard below the belt when the drapery is high and in panier fashion; but for dresses that have the round apron overskirt, these breadths may begin lower, as it is only required that they be well covered at the top.


A
B
C
D
E
0
6¼
2
4½
7½
9½
3¼
6½
13
2¾
15¾
2¼
8
f
27¼
1½
10½
46
47¼
12¾
1½
5½
8¾
9
11½
2¼
3½
12½
6
16½
9¼
2¾
17
6¼
10
16
3
8½
16¾
18
2½
9¼
21½
17¾
34
½
20
52¼
23¼
¾
4
1
1⅞
7
1¼
11½
1¾
4¾
17¼
4¼
2¼
4½
5½
54
6¼
1½
3
6
8¼
24
21¼
14
5¼
2¼
9¼
8½

LADY'S ULSTER.

The diagram represents a lady's ulster. The materials generally used for this class of garments are mixed woollens; and the quantity of cloth required to make one for a lady from 36 to 40 bust measure would be 3¼ yards of double-width (54-inch), or twice that amount of single-width (27-inch).

THE NECESSARY MEASURES.

1. Across bust from seam to seam.
2. From centre of neck at back as high as desirable, down for length of waist, and then for full length of garment.
3. Width of back from seam to seam.
4. Place tape at hollow of neck and take width of shoulder.
5. Keep tape in same position and take length of sleeve by keeping the arm at the side, and measuring down as far as the sleeve is desired to come.
6. Take bust measure all around.
7. Waist measure.

The proportionate measures for a medium or 36-inch bust would be:—

1. Across bust, 7 inches.
2. Neck to waist, 16; full length, 50.
3. Width of back, 13.
4. Width of shoulder, 4½.
5. Length of sleeve, 27.
6. Bust all around, 36.
7. Waist measure, 24.

TO DRAFT PATTERN.

Commence with Diagram C, or back; draw base line *o o*; get scale to correspond with bust measure, and place the end of it at upper angle of base line, and mark down ½, 4, 7, 11½, and 17¼. Now place inch tape at top of base line and measure down to waist, say 16 inches. The back tack or top of fold (marked 20 in diagram) may be made any length desired. Then measure full length of back, 50 inches more or less, governed of course by the height of person. Now take scale and place it at top of base line, and go out ¾ and 3¼; at 4, ¾ and 7½; at 7, 1 and 7; at 11½, 1¾ and 4¾; at 17¼, 2½ and 4¼; at 20, 2¼, 4½, and 5½; at bottom of back, at figure 54, 2¼, 5½, and 6½. When the back is marked out, apply third measure for width of back, and if too wide, reduce it to the proper width, as the back is usually too wide.

DIAGRAM A.

Draw base line *o o*. Place end of scale at top, and mark down 2, 9½, 13, and 15¾. Now place back in the position to sew to side piece, and cut side pieces to correspond in length. Take scale and go out at top of base line 6¼; at 2, 4½ and 7½; at 9½, 3¼ and 6½; at 13, 2¾; at 15, 2¾ and 8; at 27, 1½ and 10½. This measure is also taken by scale: mark down twice the length of scale, and add 3¼ inches, which will make 27¼; at this figure go out 1½ and 10½; go out at bottom 12¾ inches.

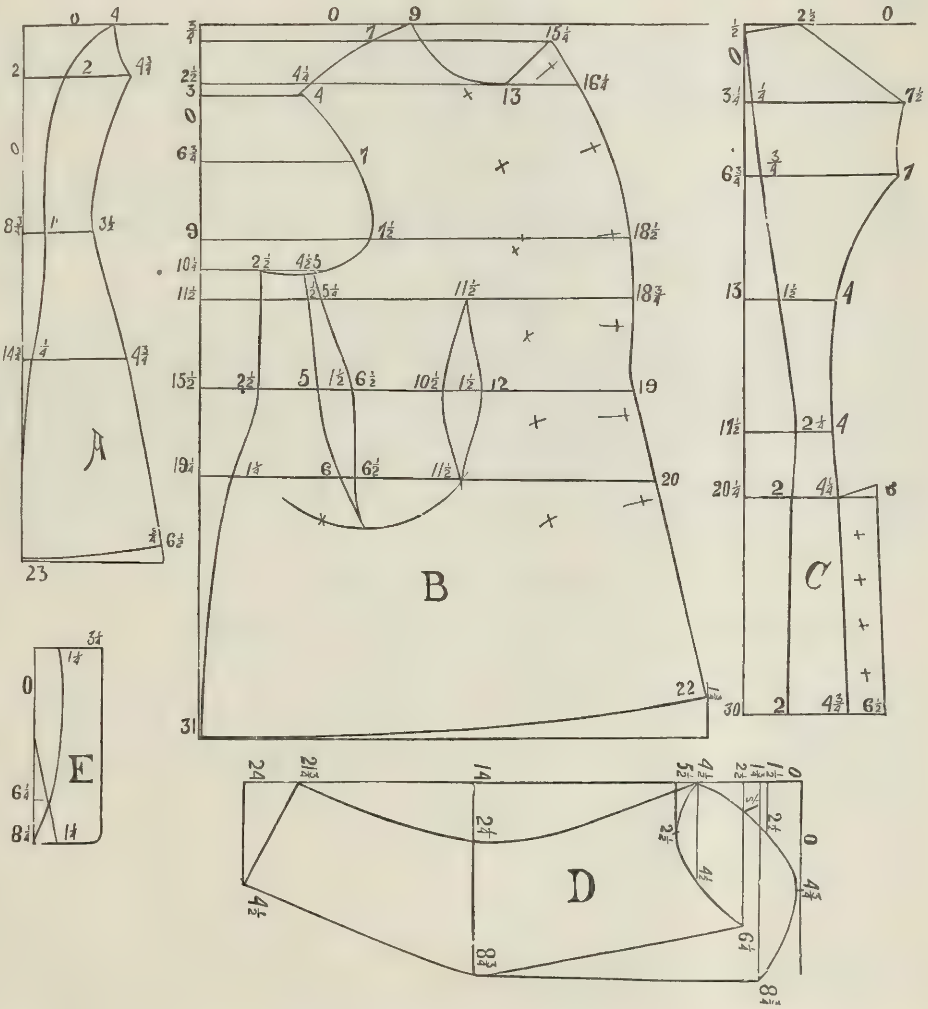
DIAGRAM B.

Draw base line *o o*. Place end of scale at angle, and go down 1¼, 2¼, 2½, 6, 9¼, 16, 18, 21½, and 34. Place side piece in position to join, which will give you the proper length on side. Go out from angle of base line 8¾; at 1¼, 5½, 9, and 14¾; at 2¼, 3½; at 2½, 12½; at 6, 6 and 16½; at 9¼, 2¾, 6¼, and 17; at 16, 3, 8½, 10, and 16¾; at 18, 2½, 8½, 9¼, and 17; at 21½, 1½, 8½, and 17¾; at 34, 1½ and 20. At the bottom, after getting length of front by side piece, either take off or add, as may be requisite, and square across the front.

DIAGRAM (Sleeve).

Draw base line. Mark down from angle 1½, 4½, 5¼, 14, 21½, and 24. At top base line go out, for width of sleeve, 4½; at 1½, 2, 6¾, and 8½; at 4½, 7½ and 8¾; at 5¼, 2½; at 14, 2¼ and 9¼; at 24, square across, and go out 4¾. The collar you can work out by following figures. When pattern is drafted, lay it on cloth as per diagram. Allow large seams, and baste up and try on.

LADY'S SACQUE.



The same measures that are taken for ulster will do for the sacque, except of course the length. This diagram will fit a 36-inch bust. Thirty inches would be the ordinary length for a walking-jacket; 1¾ yards of double-width (54-inch) cloth, or 3½ yards single-width, will be sufficient for a medium garment. When drafting pattern, commence with the back (Diagram C), then the side pieces (A), and finally the front (B). In each case, commence by drawing base line *o o*, and mark down on it the same as shown in ulster diagram, and square across.

A HOUSE JACKET may also be cut from this pattern, the back being lapped on side piece at buttons, and four or five buttons sewed on. Lay pattern on cloth as per diagram, allow for *large* seams, and baste garment together and try on. If woollen goods are to be used for the garment, they should be sponged in accordance with the directions given in the article on Men's Clothing. Procure the scale corresponding to bust measure, and draft back.

DIAGRAM C (BACK).

Draw base line *o o*. Place end of scale at angle and go down ½, 3¼, 6¾, 13, 17½, 20¼, and 30; square across. Begin at ½ and go out 2½; at 3¼, ½ and 7½; at 6¾, ¾ and 7; at 13, 1½ and 4; at 17, 2¼ and 4; at 20¼, 2, 4¼, and 6; at bottom, 2, 4¾, and 6¼.

DIAGRAM A (SIDE PIECE)

Draw base line *o o*. Place end of scale at angle and mark down 2, 8¾, 14¾, 23; square across. At top, go out 4; at 2, 2 and 4¾; at 8¾, 1 and 3½, at 14¾, ¼ and 4¾; at 23, 6½; go up as shown in diagram, ¾ from base line.

DIAGRAM B (FRONT).

Draw base line. Place scale at angle and mark down ¾, 2½, 3, 6¾, 9, 10¼, 11½, 15½, 19½, and 31. At top, go out 9; at ¾, 7 and 15¼; at 2½, 4½, 13, and 16¼; at 3, 4, at 6¾, 7; at 9, 7½, and 18½; at 10¼, 2½, 4½, and 5; at 11½, 5½ and 18¾; at 15½, 2½, 5, 6½, 10½, 12, and 19, — allowing 1½ to be taken in for dart. At 19½, go out 1¼, 6, 6½, 11½, and 20; at 31, 22; end of 31 line to be 1¾ inches from bottom. As with ulster, darts should not be taken out till the pattern is tried on. The sleeve and collar of the sacque are drafted the same as in the ulster. If you desire flaps, cut pocket mouth straight across, and place flaps over pockets in a position to cover them.

MAN'S SACK SUIT.

Five measures are necessary for coat, two for vest, and six for pants.

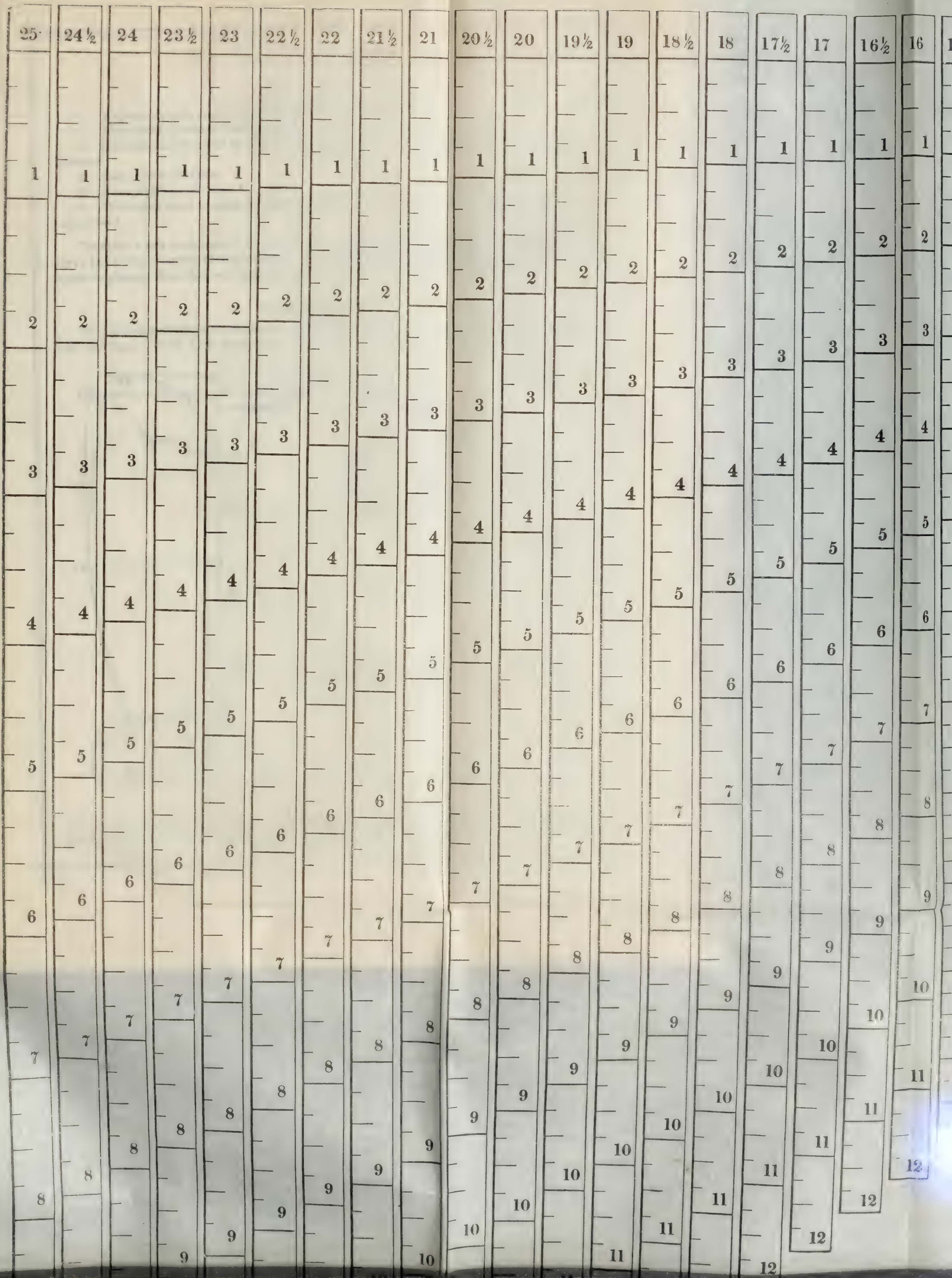
Measure for Coat.

1. Take length by placing end of tape at collar seam at back, and measure down to required length.
2. Place tape at hollow of neck, and measure over shoulder down arm at side to ball of thumb, for length of sleeve.
3. Take chest measure under arms over vest.
4. Take waist over vest.
5. Take hip measure the same way.

Measure for Vest.

1. Measure length of collar or open.
2. Measure the full length to bottom.

The coat CHEST and WAIST measure will answer for the vest.


24½
23½
22½
21½
20½
19½
18½
17½
16½

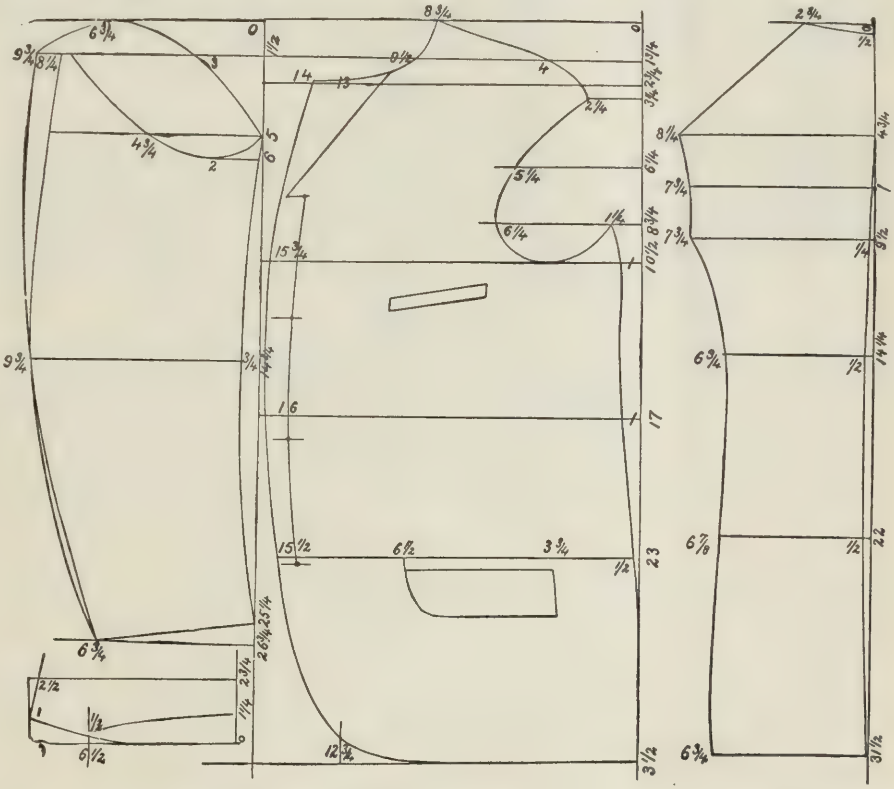
Measure for Pants.

1. **Measure outside seam from hollow over hip to heel of boot.**
2. Take waist measure under vest.
3. Seat measure is taken by placing tape around seat, the same way as you took waist measure.
4. Take width at knee.
5. Take width at bottom.
6. The inside seam is taken by placing end of tape at crotch and measuring down to sole of boot.

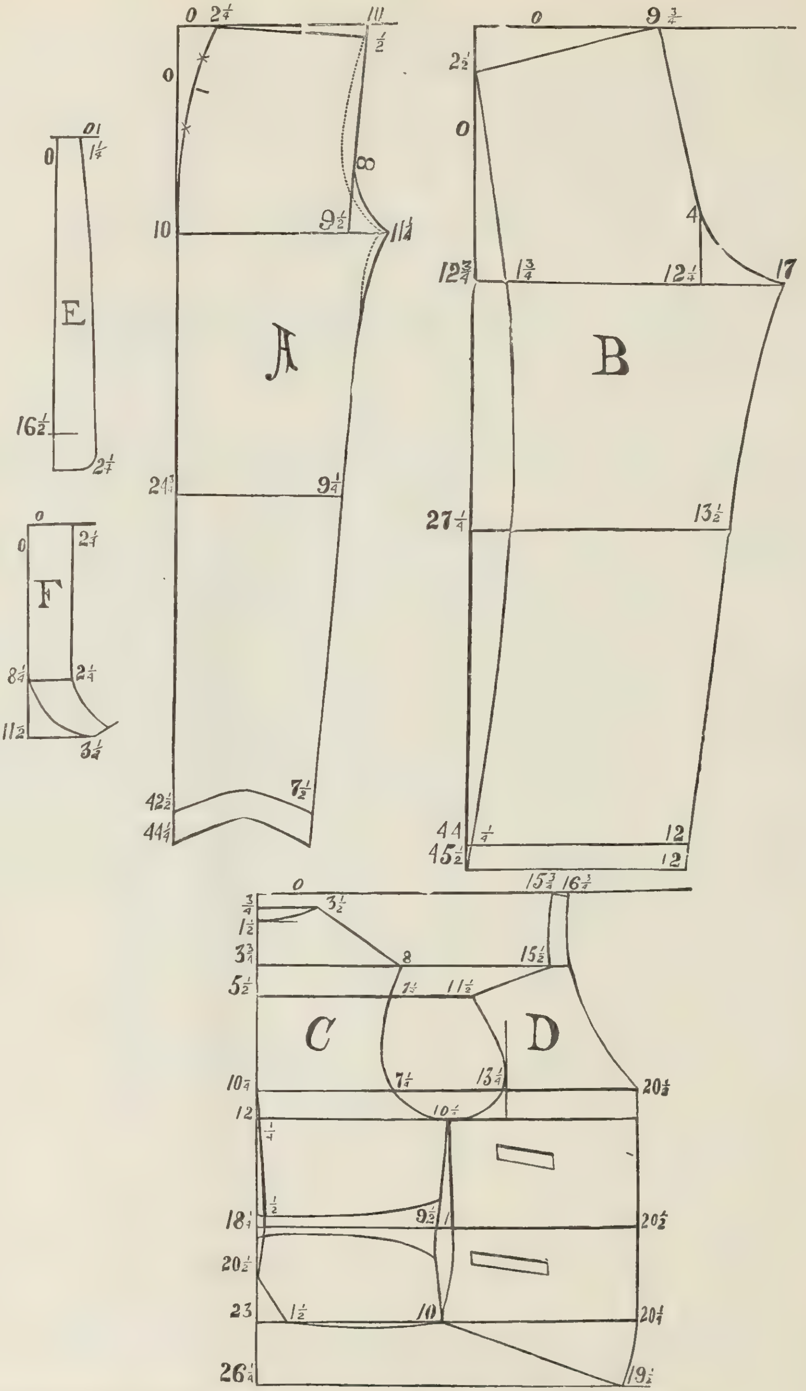
To make a suit for a man 5 feet 6 inches, 3¼ yards of double-width goods are necessary; twice that quantity of single-width. All woollen goods should be sponged, either by steam or placing them in a wet cloth for half an hour and then letting them dry.

DIAGRAM OF COAT.

To cut coat pattern, get the scale to correspond with chest measure, and cutter's square and inch tape. Draft back first; draw base line *o o*, then place scale at *o* and mark down



½ inch; keep scale in same position and mark down 4¾, 7, 9½, 14¼, and 22. Where you have to use a scale for a measure longer than itself, measure as far as scale will admit and add on


0
2¼
11
½
0
8
10
9½
11¼
A
21¾
9¼
42½
7½
44¼
0
9¾
2½
0
4
12¾
1¾
12¼
17
B
27¼
13½
44
¼
12
45½
12
0 1
0
1¼
E
16½
2¼
0
0
2¼
F
8¼
2¼
11½
3½
0
15¾
16¾
¾
3½
1½
3¾
8
15½
5½
1½
11½
C
D
10¾
7¼
13¼
20½
12
10½
¼
½
18¼
9½
1
20½
20½
23
1½
10
20¼
26¼
19½

balance. For instance, on back you have to measure down to 22: twelve parts are all there is on the scale, so you would have to add ten parts more. After you mark down to 22, then, with inch tape placed at top of back, work the full length which you have taken in measuring for coat.

Square across at base line at each of the above figures, except at the one marked ½ inch, and give the width as indicated by diagram; at base, 2¾; at 4¾, 8¼; at 7, 7¾; at 9½, 7¾ and ¼; at 14¼, ½ and 6¾; at 22, ½ and 6⅞; at bottom, 6¾. If you want to make back straight or whole. do not cut any out of centre seam.

To cut front, draw base angle at *o*; then with scale placed at *o*, work down 1¾, 2¾, 3¼, 6¼, 8¾, 10½, 17, 23. Then whatever you have added or taken from length of back, do the same to front. Square at each of the above lines (see diagram), and mark out from base line at *o*, 8¾; at 1¾, 4 and 9½; at 2¾, 13 and 14; at 3¼, 2¼; at 6¼, 5¼; at 8¾, 1¼ and 6¼; at 10½, 1 and 15¾; at 17, 16; at 23, 15½, and bottom of front to suit taste.

For sleeve, make angle *o o* and mark down with scale 1½, 5, 6, 14, and 3; square across at these numbers (see diagram); then from angle *o* across, go out 6¾; at 1½, 3, 8¼, and 9¾; at 5, 4¾; at 6, 2; at 14¾, 9¾. Now place front at top of sleeve the way it is sewed in, and measure from hollow of neck where collar is sewed on, down centre of sleeve, making the length of sleeve ½ inch longer than your measure, besides allowing two inches for turning up. For collar, draw line *o* and work down 6½ and 9; at *o* go out 1¼ and 2¾; at 6½, ½; at 9, 1 and 2½. Before cutting, measure neck of garment and then collar. If collar is too short or too long, alter at centre.

DIAGRAM OF VEST.

In measuring for vest, use scale ½ inch smaller than for coat. First draw angle *o o*, then mark down the numbers as diagram indicates, then mark out. After you have diagram drawn, compare the length of the open and the whole length of vest and cut accordingly, allowing ½ inch in length for making up, then see if the waist measure is correct. Allow two inches on each side over measure. If too wide, take out of centre of back; if too narrow, allow one half the amount on front and the balance on back.

DIAGRAM A.

In commencing to cut pants, get scale to correspond with seat measure, front Diagram A; draw angle *o*, then with scale go down 10 and 24¾; from 24¾ go out 9¼; from 10, 9½ and 11¼; from *o* go out 10; place tape at *o* on base line and measure the length you took on side seam from 11¾ opposite 10; measure down for inside seam. The best way to determine the rise of pants is the difference between the inside measure and the outside. For instance, if the inside seam was 32 and the outside 42½, the rise of pants, from angle *o* down to 10, would be 10½ inches from *o* out 10.

DIAGRAM B.

Make angle *o*, and down 2½, 12¾, and 27¼, and down the same length as Diagram A. From *o* go out 9¾; from 12¾ go out 1¾, 12¼, and 17; from 27¼ go out 13½. The width at knee and bottom is controlled by taste, or whatever the style is. The inside line on Diagram A, the right front is usually cut ½ inch smaller. If close-fitting pants are necessary, measure the waist, and if too large, take difference off at figure 9¾, Diagram B, *to nothing* at 4; and if too small, increase the size at same points to nothing at 4. Allow 1 inch in cutting for seam, both at waist and through leg, over your measure in cutting waistband E.

If the waist was 34, cut it 17½ double. Allow 2 inches in front on right side for top of fly; the fly is marked, Diagram F. The size of pants in this diagram is 32 waist by 32 leg; and if that will answer your purpose, don't cut any larger than marked. You can cut any size suit from 24 chest measure to 48, by taking proper measure, and scale to draft by.

SUIT FOR BOY.

Take the tape line and measure —

1. From collar seam at back of neck to bottom of garment.
2. Width of back from seam to seam.
3. Measure from hollow of neck, over shoulder, to the wrist.
4. Around chest under jacket.

These are all the measures required for the jacket, and tnose for short pants are as follows: —

1. Outside seam above hip-bone, down to a point just below the knee.
2. Around the waist.
3. Around the seat.

DIAGRAM C.

For long pants, see the explanation on men's suit.

To draft jacket, commence with the back, Diagram C; draw base line *o o*, and then take the scale which corresponds with chest measure and place the end of it at angle, and go down ½, 4¼, 6¼, 8¾, and 13¾. Square across at these numbers, then place the end of tape line at ½ and measure down to 16 and 22¼, or to the desired length. Now begin at the top of base line and go out 3 (with scale) at 4¼; 8¾ at 6¼; 8¾ at 8¾; 7 at 13¾; 6¼ at 16; and 6¼ at 22¼.

Next draw front Diagram B. Draw base line as usual, place end of scale at angle, and go down 1¾, 3¼, 9¾, 10¾, 16¼, 19, and 23¾. Of course the front must correspond to the length of the back. Begin at top of base line with scale, and go out 10¼; at 1¼ go out 5 and 10½; at 3¼, 3½, 14, and 17½; at 9¾, 2, 7, and 19; at 10¾, 1¾; at 16¼, 1¾ and 20; at 19, ¾ and 20½. Mark pockets as shown in diagram.

DIAGRAM A (SLEEVE).

Draw base line, and go down 1½, 4½, 5¾, and 14¾. Beginning at the top again, go out 5¾; at 1½, 2¼, 8, and 9¼; at 4½, 8¼ and 9¾; at 14¾, 9¾. Now place sleeve in position to sew in, and measure from hollow of neck to bottom of sleeve, and cut it ½ inch longer than you measured. The measure for width of back may be applied before cutting the pattern. The collar and flaps for pockets may be cut as shown in Diagrams H and G. As this pattern is for a proportionate figure, it will be well after you have cut it out to baste it up and try it on.

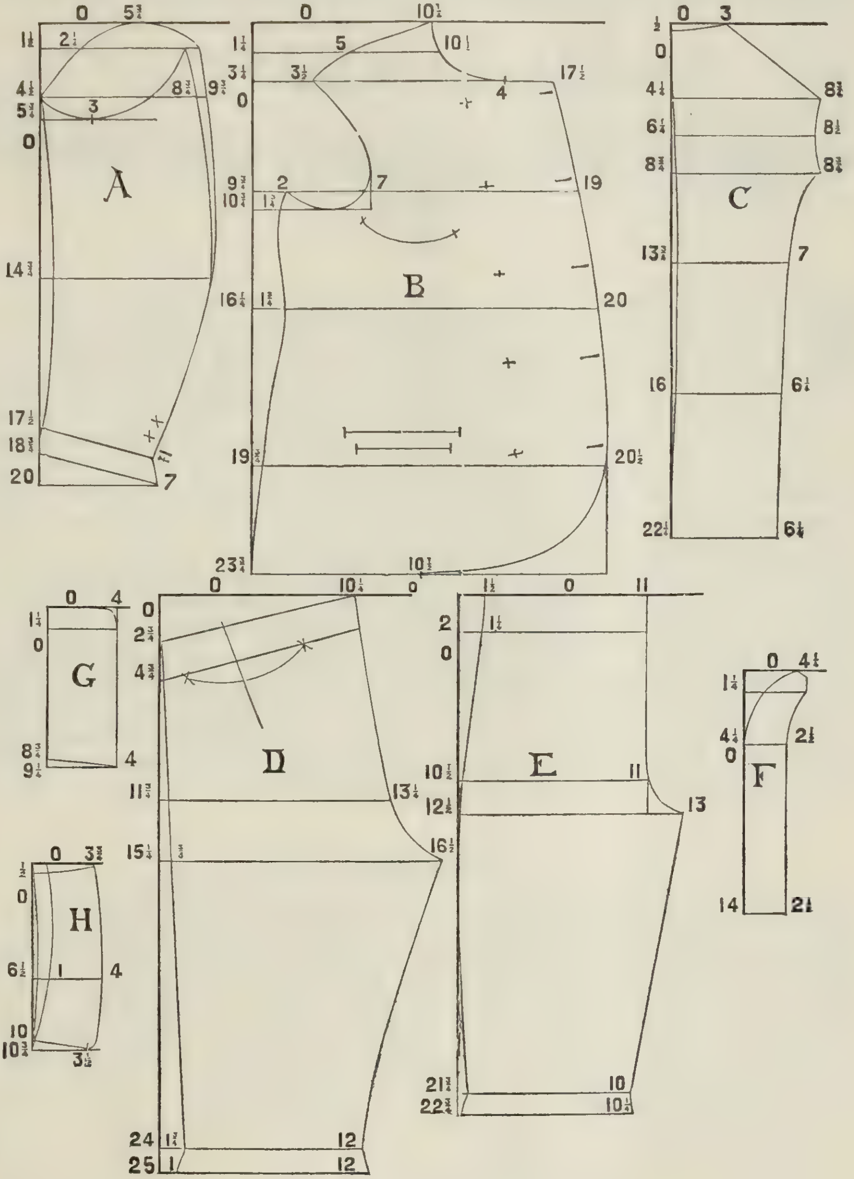
PANTS.

Draw base line and take scale to correspond with seat measure, and place the end of it at angle and go down 2, 10½, and 12½. Now take inch tape and place the end of it where scale was, and measure down the desired length and allow ½ inch over for making up. Go out by scale at bottom ½ and 10. Allow 2 inches for hem, and go out by scale 10¼ at 22¾, and square across at numbers given. Then go out at top 1½ and 11; at 2, 1¼; at 10½, 11; at 12½, 13.

DIAGRAM D (BACK).

Draw base line and go down with scale as usual, 2¾, 4¾, 11¾, and 15¼. Square across at these numbers and go out at top 10¼; at 11¾, ½ and 13¼; at 15¼, ¾ and 16½. Now place back and front together at 12½ on front and 15¼ on back; both sides of course are to be cut the same length. Then cut fly as shown in Diagram F.

The amount of goods required to make this suit for a boy of eight years is 1½ yards of double width, or 3 yards single width. The jacket may be made with or without a collar, as the neck of the jacket is suitable for either style.


A
0
5¾
1¼
2½
4½
8¾
9¾
5¾
3
0
14¾
17½
18¾
20
7
B
0
10½
1¼
5
10½
3¼
3½
17½
0
4
9¾
2
7
19
10¾
1¾
16¼
1¾
20
19¾
20½
23¾
10½
C
½
0
3
0
4½
8½
6¼
8½
8¾
8¾
13¾
7
16
6¼
22¼
6¼
D
0
10¼
0
2¾
4¾
11¾
13¼
15¼
¾
16½
24
1¾
12
25
1
12
E
1½
0
11
2
1½
0
10½
11
12½
13
21¾
10
22¾
10¼
F
0
4¼
1¼
4¼
2¼
0
14
2¼
G
0
4
1¼
0
8¾
9¼
4
H
½
0
3¾
0
6½
1
4
10
10¾
3½

MILLINERY.

INASMUCH as there is nothing so dear to a woman's heart, and very often to her husband's purse, as a "duck of a bonnet," we propose to show in this article how it is possible to indulge in such a luxury at the smallest possible outlay Of course, what would look charming on one would look ridiculous on another: so care and judgment must be exercised to secure that which is becoming to the wearer. Good taste, like every other virtue, is modest, and, therefore, anything flashy or conspicuous should be tabooed as vulgar. Ladies with broad, round faces should wear high-crowned hats small bonnets trimmed high, to appear taller, otherwise the face would appear too broad. Others, with long, oval, or thin faces, should seek the opposite effect for a like reason; that is, broad bonnets, or low-crowned hats, trimmed full.

Colors should be chosen, not because they are fashionable, but for the reason that they are becoming, otherwise ill effects will be the result. A brunette, unless she has a very clear skin, should never wear light blue, but she may wear dark colors, such as garnet, dark blue, green, cardinal, or, in light colors, straw, écru, and cream, to good advantage. Blondes, however, can wear almost all colors. In addition to the colors already named, they may wear that most trying of all colors, the terra-cotta, light or dark shades, to much greater advantage than their darker sisters. The myrtle green and crushed strawberries, etc., are among the favorite colors of the fashionable blonde. For further instructions in the harmony of colors and dress, see those articles in this work.

TRIMMING.

To face a hat or bonnet, sew the wire all around, about one fourth of an inch from the edge of the brim, then fit the velvet or satin on the brim by pinning it on the wire; turn in the edge of the material and slip stitch it on. If you want to put on a binding instead of a facing you must sew the wire on the edge of the hat or bonnet. For binding, cut a strip of velvet on the bias, about two or three inches wide, sew it on one side, then turn it over and slip stitch it on the other. For shirring, take one half yard of satin or silk cut on the bias, divide it in two equal parts, join the parts together, turn in one of the edges and put in a row of shirring, allowing just space enough to put in the wire, then add as many rows of shirring as you please. Draw all the threads sufficiently to secure a fit and sew on to the shape. For shirring, use either silk, velvet, satin, or lace. It will take to cover a plain bonnet frame about one half of a yard of velvet, or five eighths of a yard, if you wish to put on a puff binding. To put on the latter binding it generally takes two lengths of velvet or satin; join them together, then run a thread on both edges of the material; sew one side on the frame, turn it over and slip stitch it on the inside. If it is a bonnet, you can leave a raw edge, which is covered by the lining.

For trimming, take a band, about three eighths of a yard wide, cut on the bias, turn it in soft folds around the crown; put either a breast, a bunch of tips with a small wing, or a bird on one side, and you have a pretty bonnet. A stylish bonnet for a middle-aged lady is made by trimming it on one side with a long plume and on the other by a handsome bow of ribbon or a knot of velvet or satin. Another way is to take three eighths of a yard of velvet cut on the bias, catch it in the middle in a tight knot, sew it on the brim of the bonnet previously bound, then draw the velvet on each side of the bonnet in soft folds, so as to make it puffy; it forms a large bow, and is very neat.

When a hat is large after facing it, you can use one or two large plumes in trimming, and it is considered proper to have them both fall on one side; then place a large twist of velvet, if in winter, or a soft fall of lace in summer, on the other side of the hat, and catch in with an ornament or a bird. A breast may also be used, or a large bow of ribbon may be put on the trim of the hat.

To make a stylish bow of ribbon, take one and one half yards, from three to four and one half inches wide; double about one fourth of a yard, draw it in tight folds, then twist the thread around tight; make as many loops as you have ribbon without cutting it; put a knot in the middle, and arrange your loops so as to lay flat on the hat. Another pretty bow is made with one or two strips of satin or velvet cut on the bias, one fourth of a yard wide; gather in the middle, form equal loops on each side, and finish with an ornament in the centre.

Beads may be used in the making of a bonnet by putting a row round the brim of the bonnet or hat. They are also used across the back of the bonnet. They look well either with flowers or feathers, but generally only feathers are used on a hat with beads, and flowers or small tips are used on bonnets. Beads are not used for trimming as much as in former years, nevertheless jet bonnets are still fashionable and look well. A jet bonnet is easily made by covering a frame with black satin, or with thin black silk, with several thicknesses of black ground lace. Cardinal satin may also be used. Next put a jet crown, then a couple of rows of beaded lace slightly fulled. If you desire it high in front, puff a little plain black lace under the beaded lace. A bunch of flowers or tips at the side is all that is needed to complete the bonnet.

Gros-grain and the ottoman ribbons are more fashionable than satin; nevertheless the latter are still worn and look pretty, and are cheaper than the silk.

TO RESTORE RIBBONS AND LACES.

To freshen ribbon or laces, take one part of alcohol, two parts of water, mix together, then rub the ribbon or lace with the solution, and cover with a piece of muslin to prevent the iron from giving it a gloss. For colored ribbons, use only a wet piece of muslin over the ribbon without using the solution. Some milliners prefer a weak solution of ammonia to the one mentioned. For white laces, use a small quantity of gum arabic dissolved in water. Have it slightly sticky. Another method for colored laces is to dip the lace in bluing water, and wind it, without pulling, around a bottle, allowing it to remain on the bottle till it dries. The bluing imparts a rich color to the lace without making it glossy or stiff.

TO RENEW CRAPE.

To refinish crape, take two parts of alcohol to one part of water, mix together; then take about three fourths of a yard of thin black lining silk, wash it well to take off all the dressing, dip it in the solution, wring it, then lay it over the crape, which has been previously well stretched on a piece of cloth; take a hot flat-iron and draw it lightly over the silk without touching the crape. It will in this manner steam the crape, which will retain its folds and look like new. Another method is to lay a wet cloth on a hot stove and hold the crape over the steam which rises from the cloth.

TO RESTORE FEATHERS.

Feathers are restored by shaking them over steam; then continue shaking over a hot stove until dry. Curl all the fibres separately with a blunt knife, or the back of a pair of scissors.

TO ALTER SIZES OF BONNETS OR HATS.

If you wish to enlarge a bonnet frame where the head size is too small, introduce a V on each side or one at the back. You can also put one in the brim. If it is too small in front or sides, add a piece of buckram the size you wish to make the frame by sewing it on the edge, then sew on the wire, which, of course, must be removed before the frame can be pieced. To make a frame smaller, remove your wire, cut off what you please, then replace wire as before. You can also enlarge felt, straws, or chips in the same manner, the trimming and binding covering all. Another method is to cut out a Λ at the back and draw the parts together, which of course reduces the size.

MOURNING.

For deep mourning crape only is used, and the bonnet must be made perfectly plain to look well; a long veil put on plain, just folded on the sides of the bonnet so as to fall gracefully on each side of the face. The usual width of crape for veils is 4/4; the length, all finished, is 1½ or 1¾ yards long. To make a veil 1½ yards long you must get 1¾ yards of crape; make a hem ¼ yard deep for the lower part of the veil, then a hem 1½ inches deep on each side, and a narrower one for the top.

Crape and silk are used for lighter mourning. As a great many persons object to wear crape, a plain black silk bonnet can be worn, with dull jet beads on the edge; one or two rows can be used.

To make a pretty black silk bonnet, put on a plain crown and side-crown, then put three or five small folds or cords on the brim. If you do not wish to use beads, take a large piece of silk, cut on the bias, about ½ yard; lay it in soft folds around the front, then a soft black wing on the side. If you desire to trim your bonnet altogether in silk, take two pieces of ¼ or ⅜ yard silk, cut on the bias, and cross over the folds to make a light trimming. There are also dull jet ornaments that can be used to suit the taste.

A little courage, coupled with observation, will enable the merest tyro to do her own millinery in an acceptable manner. It is easy to ascertain the prevailing fashion, and any bright girl who believes in sensible economy will find no trouble in mastering the mysteries of trimming after a careful study of this article and the dissecting of one or two old bonnets, or the intelligent scrutiny of milliners' windows.

COAT OF ARMS OF EACH STATE.

Maine.

Connecticut.

New Hampshire.

New York.

FREEDOM AND UNITY.

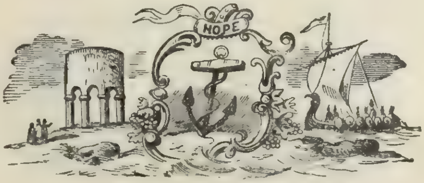
Vermont.

New Jersey.

ENSE PETIT PLACIDAM SUB LIBERTATE QUIETEM

Massachusetts.

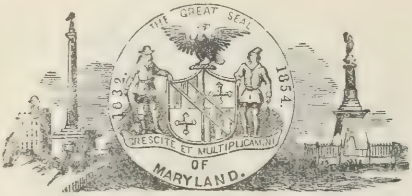
Pennsylvania.



Rhode Island.

Delaware.

COAT OF ARMS OF EACH STATE.



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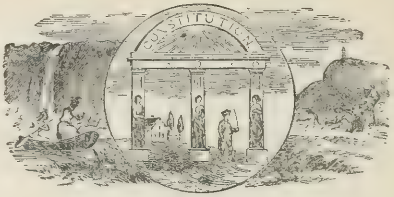

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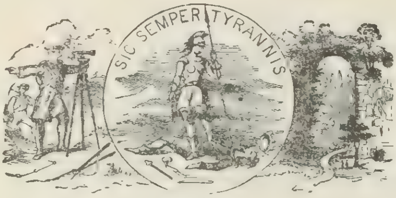


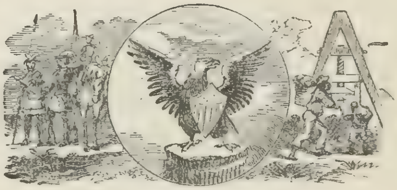
Virginia.

Florida.

West Virginia.

Alabama.

North Carolina.

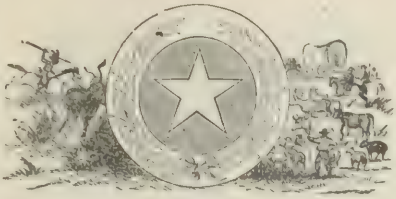


Mississippi.

South Carolina.

Louisiana.

COAT OF ARMS OF EACH STATE.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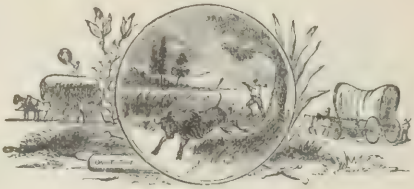
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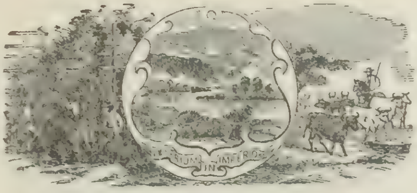
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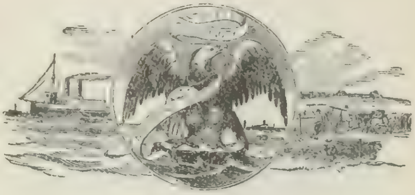
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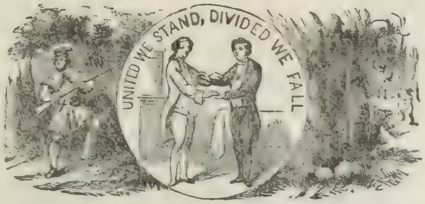
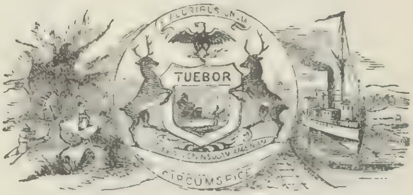

UNITED WE STAND, DIVIDED WE FALL
Kentucky.



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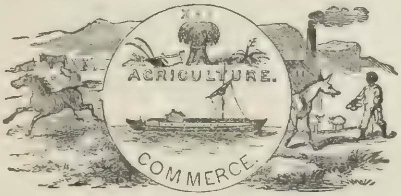

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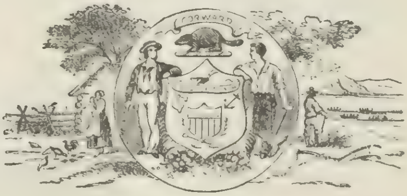

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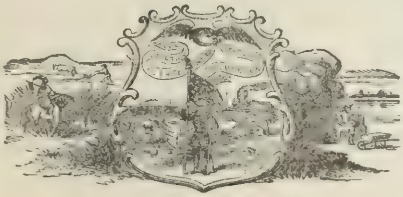
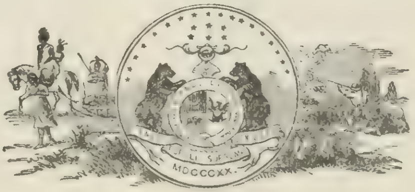
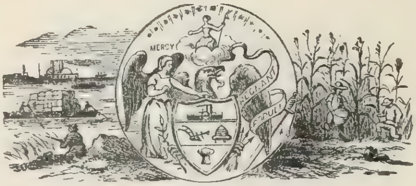

Iowa.

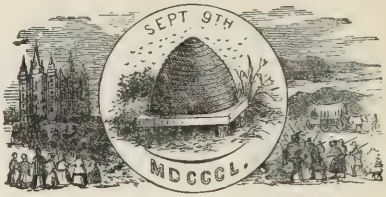


Missouri.

COAT OF ARMS OF EACH STATE.



Arkansas.



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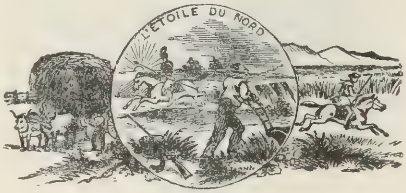

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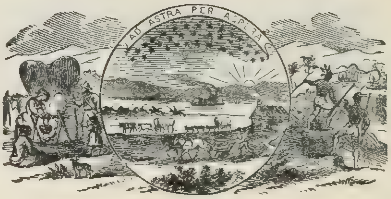

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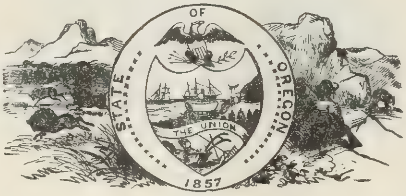

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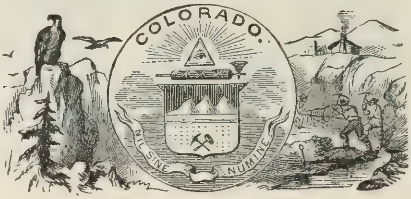

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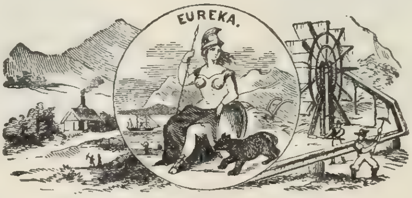

California.

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